

N83447.AR.000142
NAS FORT WORTH
5090.3a

CONTRACTOR QUALITY CONTROL PLAN ADDENDUM GROUNDWATER REMEDIATION
SYSTEM INSTALLATION LANDFILLS 4 AND 5 NAS FORT WORTH TX
1/1/1994
INTERNATIONAL TECHNOLOGIES



179 0

**NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
TEXAS**

**ADMINISTRATIVE RECORD
COVER SHEET**

AR File Number 179

File: 177-2;
D.B. 177A-30

179 179

Project No. 305895
January 1994



Final Plan

Contractor Quality Control Plan (Addendum)
Groundwater Remediation System Installation and Startup
Landfills 4 and 5 (Carswell)
Air Force Base Plant 4
Fort Worth, Texas

Contract No. DACA56-92-D-0008
Delivery Order No. 0013

Prepared for:

Department of the Army
Tulsa District, Corps of Engineers
Tulsa, Oklahoma



Prepared by:

ITT Corporation
Monroeville, Pennsylvania

179 2

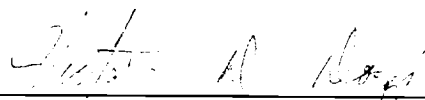
CONTRACTOR QUALITY CONTROL PLAN (ADDENDUM)

**GROUNDWATER REMEDIATION SYSTEM
INSTALLATION AND START-UP**


**LANDFILLS 4 AND 5 (CARSWELL)
AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS**

**Contract No: DACA56-92-D-0008
Delivery Order No: 0013**

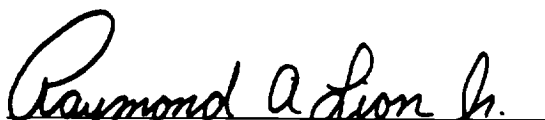
Reviewed and Approved By:




Project Manager, IT Corp.



Date



QA/QC Manager (GORAP), IT Corp.



Date

Table of Contents**1.79 3**

List of Tables/List of Figures	iii
List of Drawings	iv
1.0 Delivery Order Description	1-1
1.1 Introduction	1-1
1.2 Project Background	1-2
1.3 Groundwater Remedial Actions	1-2
2.0 Project Quality Control Organization and Responsibility	2-1
2.1 Project Quality Control Personnel	2-1
2.2 Quality Control Support	2-2
3.0 Project Scope and QA/QC Requirements	3-1
3.1 Quality Control Inspections	3-1
3.2 Technical QA/QC Program	3-2
3.2.1 Below Grade Groundwater Collection Pipe and Electrical Conduit ...	3-2
3.2.2 Below Grade Treated Water Discharge Pipe	3-4
3.2.3 Groundwater Pumping System in Existing Recovery Well CAR-RW2	3-5
3.2.4 Rental Modular Air Stripping Treatment Unit	3-6
3.2.5 Groundwater Pumping Systems in Seven Existing Recovery Wells ...	3-7
3.2.6 Long-Term Modular Air Stripping Treatment Units	3-8
3.2.7 Fence for Groundwater Treatment Units	3-10
3.2.8 Operation and Maintenance for Groundwater Treatment Units	3-11
4.0 On-Site Documentation	4-1
4.1 Field Activity Daily Log	4-1
4.2 Daily Construction Quality Control Report	4-2
5.0 Nonconformance and Corrective Action	5-1
6.0 Change Control	6-1
7.0 Reporting Results	7-1
8.0 Records Management	8-1
8.1 Retention of Records	8-1
8.2 Record Filing Systems	8-1

Table of Contents *(continued)* **179** **4**

8.3	Record Control	8-1
8.4	Record Status	8-1
8.5	Record File Categories	8-2
8.5.1	Category A: Correspondence	8-2
8.5.2	Category C: Originals	8-4
8.5.3	Category D: Bids, Contracts, and Specifications	8-4
8.5.4	Category E: Field Data and Field Data Checkprints	8-5
8.5.5	Category F: Calculations and Calculation Checkprints	8-6
8.5.6	Category H: Submittals	8-6
8.5.7	Category I: Photographs	8-7
8.5.8	Category K: Laboratory Data	8-7
8.5.9	Category L: Regulatory Submittals and Licensing and Permitting Applications	8-7
8.5.10	Category M: Reference Materials	8-7
8.5.11	Category N: Site Monitoring and Health and Safety Records	8-7
8.5.12	Category O: Drawing and Table Checkprints	8-8
8.5.13	Category Q: Quality Records	8-8

Figures

Drawings

Appendices

List of Tables

Table	Title	Page
2-1	IT Personnel and Responsibility Matrix	2-3
2-2	Subcontractor Listing	2-4
3-1	QA/QC Inspection and Testing Program	3-13

List of Figures

Figure	Title
1	Site Location Map
2	Project Quality Control Organization Chart
3	Preparatory Inspection Form
4	Final Inspection Form
5	Field Activity Daily Log
6	Construction Quality Control Report
7	Record of Technical Change

List of Drawings

<i>Drawing</i>	<i>Title</i>
305895-E3	Site Plan and Treatment Facility
305895-E1	Plan, Groundwater Recovery System
305895-E2	Details, Groundwater Recovery System
305895-E4	Process Flow Diagram and Mass Balance
305895-E8	Piping and Instrumentation Diagram, Legend (1 of 3)
305895-E6	Piping and Instrumentation Diagram, Recovery Wells (2 of 3)
305895-E7	Piping and Instrumentation Diagram, Typical System (3 of 3)

1.0 Delivery Order Description

1.79 7

1.1 Introduction

This document presents the Contract Quality Control Plan (CQCP) for the work to be performed during the groundwater remediation project at Air Force Base Plant 4, Landfills 4 and 5 (LF 4/5) at Carswell Air Force Base (AFB) in Fort Worth, Texas. IT Corporation (IT) is contracted with the U.S. Army Corps of Engineers (USACE) to provide remedial design and remedial action, including design, installation, system start up, operations, maintenance, and related quality assurance/quality control (QA/QC), for the groundwater remediation project. The CQCP is prepared for the USACE, Tulsa District Program under Contract DACA56-92-D-0008, Delivery Order No. 0013. This plan is prepared as an addendum to the Quality Assurance Management Plan (QAMP) prepared for the USACE, Tulsa District Program. This plan focuses on specific QA/QC activities, including inspection, testing, and verification procedures, for contractual elements required to implement groundwater remediation at the project site. The QAMP primarily establishes processes for contractual elements of the program.

The complete scope of work for the project has been identified in the letter of Request for Quotation (RFQ), dated June 14, 1993. Procedures and requirements for the installation, operation, and maintenance of the groundwater remediation system have been specified in the equipment and installation subcontractor specifications (Appendix A). These specifications are utilized as a basis for the QA/QC requirements presented herein.

This CQCP describes the Delivery Order and project background in Chapter 1. Organization and responsibility of the Delivery Order are presented in Chapter 2. Detailed project scope and QA/QC requirements are described in Chapter 3. QA/QC requirements for field documentation are presented in Chapter 4. Nonconformance of contractual requirements and corrective actions are discussed in Chapter 5. Change control, including documentation, review, approval, and notification, is presented in Chapter 6. Reporting requirements for QA/QC results are discussed in Chapter 7. Procedures for records management are deliberated in Chapter 8.

1.2 Project Background

The LF 4/5 area where the groundwater is to be remediated is a small portion of the total area of Air Force Base Plant 4 and is located on the eastern side of Carswell AFB Taxiway 191.

Figure 1 shows the general location of this area.

Previous investigations have shown this area to contain unconsolidated sediments (upper zone) with trichloroethylene (TCE) contamination. Based on analytical data collected by Radian Corporation in 1990, the TCE contamination forms a narrow concentrated central plume paralleling a bedrock valley with the thickest portion of the upper zone sand and gravels at the project site. A broader, lower-concentrated outlying plume is moving in the direction of the upper zone groundwater flow.

IT has designed a groundwater recovery system to partially capture the contaminated plume and a treatment scheme which primarily utilizes air stripping technology for the contaminated groundwater. Upon completion of treatment, the treated water is to be discharged to a designated sanitary sewer manhole connecting to a publicly owned treatment work (POTW) of the Fort Worth Water Department.

1.3 Groundwater Remedial Actions

A description and list of all remedial actions, including collection, treatment, and discharge, that are to be performed for groundwater remediation at the project site are presented in the RFQ and subcontractor's proposal (Appendix B). The remedial activities listed below that have been identified as containing QA/QC components include the following:

- Installation of below grade groundwater collection pipe and electrical conduit
- Installation of below grade treated water discharge pipe
- Installation, operation, and maintenance of a groundwater pumping system in existing recovery well CAR-RW2
- Installation, operation, and maintenance of an modular air stripping treatment unit on rental basis as interim measure
- Installation, operation, and maintenance of groundwater pumping systems in seven existing recovery wells

- Installation, operation, and maintenance of five modular air stripping treatment units for long-term groundwater remediation.

Detailed work items and the related QA/QC requirements for the above-mentioned components are presented in Chapter 3.

2.0 Project Quality Control Organization and Responsibility

2.1 Project Quality Control Personnel

An organization chart for the groundwater remediation project at the LF 4/5 area is presented in Figure 2. This chart identifies responsibilities and lines of communication among personnel of USACE and/or Air Force Base Plant 4, IT, and subcontractor. A personnel matrix which identifies individual QA/QC responsibilities is included as Table 2-1. A listing of identified subcontractors is included as Table 2-2. A description of the QA/QC responsibilities of IT project management and home office support is provided in the QAMP. The specific responsibilities of the project personnel are described below:

Project Manager, Victor Dozzi. The Project Manager is responsible for the overall project contractual, technical, cost, and schedule elements. This includes all identified deliverable submittals in adherence with project schedule, as well as nonconformance, corrective action, and change control.

QA/QC Manager (GORAP), Ray Lion. The QA/QC Manager for the project is responsible for project adherence to all program and internal QA/QC policies. This includes review and approval of the CQCP, QA/QC documentation, nonconformance, corrective action, and change control.

Safety and Health Officer, Warren Houseman. The project Safety and Health Officer is responsible for project adherence to all program and internal health and safety policies. This includes review and approval of the Site Safety and Health Plan (SSHP) and modifications, if required, prior to and during the groundwater remedial activities.

Project Engineer, David Kochendorfer. The Project Engineer is responsible for the technical elements associated with the groundwater remedial activities. This includes review and approval of technical aspects for CQCP, nonconformance, corrective action, and change or modification, as needed.

QC Representative, Karl Eisenhart. The QC Representative is responsible for performing all project specific and program QA/QC requirements as identified in the QAMP,

CQCP, SSHP, and the Field Sampling, Analysis, and Testing Plan (FSATP). The QC Representative shall have, as his sole responsibility, the task of verifying compliance with the specifications and implementing the QA/QC requirements. He has the authority to reject material and/or workmanship which does not comply with the specifications or performance standards as set forth in the aforementioned documents. The QC Representative or his designee will physically be present at the project site when quality related work is in progress. **1.79 11**

The following summarizes the responsibilities of the QC Representative:

- Participate in all QA/QC related meetings and/or teleconference
- Perform required work inspections to verify compliance with project requirements
- Monitor compliance of SSHP
- Prepare a daily quality control report to document field activities and QA/QC activities
- Collect the required submittals from the subcontractor and include in daily reports, as appropriate
- Verify that field personnel are familiar with and adhere to proper sampling procedures, field measurement techniques, and sample identification and chain-of-custody procedures
- Coordinate with the laboratories for receipt of samples and the reporting of analytical results
- Communicate with USACE and/or Air Force Base Plant 4 and IT home office on a regular basis.

2.2 Quality Control Support

The QC Representative will be supported by other technical staff with specialized skills necessary to provide task-specific quality control. Final authority in quality control rests with the QC Representative. All outside work, e.g., shop fabrication, must meet IT's quality standards as well as those established, by contract, for this project.

Table 2-1
IT Personnel and Responsibility Matrix

Authorized Employee	Position of Employee	Responsibilities	Submittals
Victor Dozzi	Project Manager	Overall project contractual, technical, cost, and schedule	All project related submittals
Ray Lion	QA/QC Manager (GORAP)	Preparation, review, and approval of CQCP and modifications, implementation of all QA/QC requirements and internal QA/QC policies	CQCP and modifications, as required; Daily QA/QC reports upon review
Warren Houseman	Safety and Health Officer	Preparation of SSHP, implementation of all SSHP requirements and internal health and safety policies	SSHP and modifications, as required; Incident reports, if any
David Kochendorfer	Project Engineer	Review and approval of technical aspects for CQCP, nonconformance, corrective action, and change or modification, as needed.	Reports for nonconformance, corrective action, and change, upon review
Karl Eisenhart	QC Representative	Verifying compliance with specifications, QAMP, CQCP, SSHP, and FSATP; and implementing the QA/QC requirements.	All QA/QC related documentation by IT and subcontractors
Terri Robinson and Mike Cottrell	Home Office Support	Administer and track project in compliance with program control requirements	Project Status Reports

179 13

Table 2-2
Subcontractor Listing

Subcontracting Activity	Company and Contact	Address and Telephone
Piping, Equipment, and Start up for Groundwater Pumping and Treatment System	Remsys Industries Attn: Steve Erickson	608 Shelby Road Everman, TX 76140 Tel: (817) 293-2277
Construction Material Testing Services	Rone Engineers Attn: Charles Jackson	11234 Goodnight Lane Dallas, TX 75229 Tel: (214) 241-4517
Analytical Services	IT Corporation (Analytical Services) Attn: Jon Bartell	Suite 160 5307 Industrial Oaks Blvd. Austin, TX 78735 Tel: (512) 892-6684

3.0 Project Scope and QA/QC Requirements

This chapter provides details of the QA/QC requirements for the groundwater remediation project at LF 4/5 area at Carswell AFB. It also presents the detailed scope of work and acceptance criteria developed in accordance with the specifications for equipment and workmanship for groundwater pumping and treatment system. The QA/QC program developed for this project will achieve the project objectives in an effective and efficient manner. In addition, IT's Corporate Quality Assurance Program provides added structure in monitoring quality related activities. Subcontractors shall familiarize themselves with this plan and pertinent documents prior to commencement of work. A summary of the project specific QA/QC requirements is presented in Table 3-1.

3.1 Quality Control Inspections

This quality control program provides an organized procedure to monitor compliance with the applicable specifications (Appendix A) through a series of inspections before, during and after each identified activity. A meeting shall be held prior to each activity by the QC Representative with appropriate project personnel to review the project requirements and discuss the inspection and sampling procedures.

A four-step, activity control inspection system will be implemented by the QC Representative. This system consists of preparatory inspections, initial inspections, follow-up inspections and completion inspections by which IT will verify that the work complies with the project requirements. All inspections will be documented by the QC Representative.

Preparatory Inspections. Preparatory inspections will be performed prior to beginning each site predefined feature of work:

- Review the project requirements in the specifications and plans and other pertinent project documents
- Examine the work area to ascertain that all preliminary work has been completed
- Verify all field dimensions and preconstruction conditions
- Verify equipment and materials are conforming to the contract specifications and equipment and materials are readily available.

As a minimum, the QC Representative and personnel performing the particular feature of work shall participate in the preparatory inspection. A sample Preparatory Inspection Form is provided in Figure 3.

Initial Inspection. After a predetermined amount of work is performed, an initial inspection shall be conducted. The QC Representative and personnel performing the particular feature of work shall participate in the initial inspection. The initial inspection includes an examination of the quality of workmanship and a review of the controls implemented to comply with the project requirements in the specifications and plans.

Follow-Up Inspections. The QC Representative will conduct daily follow-up inspections to verify the continuing compliance with the specification and plans.

Completion Inspections. Completion inspections shall be performed when a feature of work is completed. The USACE or its representative shall be present during these inspections. A Final Inspection Form must be filled out by the QC Representative. A copy of this form is provided as Figure 4.

3.2 Technical QA/QC Program

This project involves groundwater collection, treatment, and discharge at the project site. This section provides a discussion of each work item and includes QA/QC requirements to achieve the project performance criteria in accordance with the specifications and plans.

3.2.1 Below Grade Groundwater Collection Pipe and Electrical Conduit

Prior to and in conjunction with the installation of groundwater pumping and treatment system, a network of below grade groundwater collection pipe and electrical conduit as shown on the attached Groundwater Recovery System - Plan (305895E1) and Groundwater Recovery System - Details (305895E2) will be constructed. The collection pipe and conduit shall connect the eight existing groundwater recovery wells to a treatment system located at the northern end of White Settlement Road. The piping will also be used as part of an interim measure to connect recovery well CAR-RW2 to a rental air stripping unit. The piping may also be used as part of a future expansion to connect additional recovery wells to the treatment system.

This task shall include trench excavation, pipe bedding, installation of PVC water pipe and PVC conduits, trench back filling, and concrete patching. The scope also includes installation of well head valve boxes with the indicated valves and meters, pipe tee valve boxes, conduit pull boxes, and clean outs as indicated on the drawings.

QA/QC activities that are related to this task include:

- Confirm that the associated civil/construction work (i.e., trench excavation, pipe bedding, installation of PVC water pipe and PVC conduits, trench back filling, and concrete patching) are conducted in accordance with the lines and grades as required in the plans, upon receipt of approval from the permitting agencies, as needed
- Verify that construction activities are conducted in conformance with SSHP and OSHA requirements
- Verify that the subcontractor has conducted survey of the existing structures and has marked utility lines prior to any ground penetration and excavation work
- Inspect and confirm that excavation, trenching, and backfilling are performed in conformance with Section 02222 of the specifications for products and execution
- Inspect and confirm that the below grade water discharge pipe is installed in conformance with Section 02660 of the specifications for materials (i.e., pipe, fittings, joints, valves, valve boxes, valve pits, and meters) and execution
- Inspect and confirm that the valve pits, valves, piping, fittings, and accessories are installed in conformance with Section 02699 of the specifications for materials (i.e., concrete valve pits and accessories, valves, piping and fittings, pressure gauges, and miscellaneous metal) and execution
- Inspect and confirm that concrete patching is performed in conformance with Section 03300 of the specifications for products and execution
- Confirm that all required submittals from the subcontractor be submitted in a timely manner and be complete as described in the aforementioned sections of the specifications, including but not limited to the following items: data, drawings, instructions, schedules, statements, reports, certificates, samples, records, and operation and maintenance manuals

- Confirm that QA/QC testing activities associated with the below grade treated water discharge pipe are conducted by the subcontractor in accordance with the QA/QC requirements summarized in Table 3-1.

3.2.2 Below Grade Treated Water Discharge Pipe

This task involves installation of a below grade treated water discharge pipe as shown on the attached drawings (Drawing Nos. 305895E1 and 305895E2). The discharge pipe shall connect the treatment system to the sanitary sewer manhole discharging to Fort Worth Water Department as identified on the drawings. This task shall also include trench excavation, pipe bedding, installation of PVC water pipe, trench back filling, and asphalt patching.

QA/QC activities that are related to this task include:

- Confirm that all required plans and permits have been approved by the USACE, POTW (Ft. Worth Water Dept.), and permitting agencies, if applicable, prior to implementing this task
- Confirm that the associated civil/construction work (i.e., trench excavation, pipe bedding, installation of PVC water pipe and PVC conduits, trench back filling, and concrete patching) are conducted in accordance with the lines and grades as required in the plans
- Verify that construction activities are conducted in conformance with SSHP and OSHA requirements
- Verify that the subcontractor has conducted survey of the existing structures and has marked utility lines prior to any ground penetration and excavation work
- Inspect and confirm that excavation, trenching, and backfilling are performed in conformance with Section 02222 of the specifications for products and execution
- Inspect and confirm that the below grade treated water discharge pipe is installed in conformance with Section 02660 of the specifications for materials (i.e., pipe, fittings, joints, etc.) and execution
- Inspect and confirm that concrete patching is performed in conformance with Section 03300 of the specifications for products and execution
- Confirm that all required submittals from the subcontractor be submitted in a timely manner and be complete as described in the aforementioned sections of the specifications, including but not limited to the following items: data,

drawings, instructions, schedules, statements, reports, certificates, samples, records, and operation and maintenance manuals

- Confirm that QA/QC testing activities associated with the below grade treated water discharge pipe are conducted by the subcontractor in accordance with the QA/QC requirements summarized in Table 3-1.

3.2.3 Groundwater Pumping System in Existing Recovery Well CAR-RW2

A groundwater pumping system shall be installed in the existing recovery well CAR-RW2. The system shall include a stainless steel submersible well pump capable of delivering 30 gpm at 110 ft TDH (Grundfos Model 25S10-7 or equal). The pump shall be installed with 1½-inch stainless steel riser pipe, well seal, and level control electrodes. A locking and weather tight control panel shall be installed near the well head. The control panel shall contain the pump motor starter, level relay, on-off-auto switch, and running indicator light.

Electrical power for the pump shall be provided from the treatment unit as indicated.

Electrical power wires for the pumping system in CAR-RW2 shall be pulled through the conduit installed. Control wires from the treatment unit to CAR-RW2 shall also be pulled through the existing conduit. Control shall be provided to shut down the recovery well if there is low air flow through the air stripper or if there is a high level in the air stripper sump.

QA/QC activities that are related to this task include:

- Confirm that the groundwater pumping system, including pump, riser pipe, well seal, level sensors, and control panel, is installed in accordance with the RFQ and subcontractor's proposal as approved by IT
- Verify that electrical power for the pump is provided from the treatment unit as indicated and power wires and control are installed in accordance with the RFQ and subcontractor's proposal as approved by IT
- Confirm that all required submittals from the subcontractor be submitted in a timely manner and be complete as indicated in the RFQ and subcontractor's proposal as approved by IT, including but not limited to the following items: data, drawings, instructions, schedules, statements, reports, certificates, samples, records, and operation and maintenance manuals

- Confirm that QA/QC testing activities associated with the groundwater pumping system in the existing recovery well CAR-RW2 are conducted by the subcontractor in accordance with the QA/QC requirements summarized in Table 3-1.

3.2.4 Rental Modular Air Stripping Treatment Unit

A modular air stripping treatment unit will be erected on site. The unit shall be capable of treating 30 gallon per minute (gpm). The unit shall include a low profile air stripper, blower, sump, transfer pump, bag filter, two 500 lb steel carbon canisters, and initial charge of virgin liquid phase granular activated carbon. The unit shall be skid mounted, prepiped, prewired, and pretested in the shop and completed with a control panel and all electrical, control, and instrumentation components required to operate the unit.

The air stripping unit shall be installed at the northern end of White Settlement Road. The air stripping skid shall be securely mounted on the asphalt pavement with cinch-anchors. The skid shall be designed to provide containment for the total liquid volume of all vessels on the skid. The influent and discharge of the treatment unit shall be connected to the collection and discharge pipe systems as indicated on the drawings.

Electrical power for the air stripping unit shall be connected from a power source as identified by Air Force Base Plant 4 personnel. Control wires from the treatment unit to CAR-RW2 shall be pulled through the existing conduit. Protection devices shall be provided to shut down the recovery well if there is low air flow through the air stripper or if there is a high level in the air stripper sump.

QA/QC activities that are related to this task include:

- Inspect and verify that the delivered air stripping treatment unit is a prepiped, prewired, and pretested complete package, consisting of low-profile air stripper, blower, sump, transfer pump, bag filter, steel carbon canisters, initial charge of virgin liquid phase granular activated carbon, and electrical and instrumentation, as indicated in the RFQ and subcontractor's proposal as approved by IT
- Verify that the air stripping unit is installed at location as indicated and is securely mounted on the asphalt pavement with cinch-anchors

- Confirm that the skid is provided with containment for the total liquid volume of all vessels on the skid
- Verify that the influent and discharge of the treatment unit are connected to the collection and discharge pipe systems as indicated on the plans
- Verify that electrical power for the treatment unit is connected from a power source as identified by Air Force Base Plant 4 personnel and power wires and control are installed in accordance with the RFQ and subcontractor's proposal as approved by IT
- Confirm that all required submittals from the subcontractor be submitted in a timely manner and be complete as indicated in the RFQ and subcontractor's proposal as approved by IT, including but not limited to the following items: data, drawings, instructions, schedules, statements, reports, certificates, samples, records, and operation and maintenance manuals
- Inspect and confirm that the air stripper, transfer pump, blower, bag filter, and carbon canister are in conformance with Sections 11301, 11211, 11310, 11320, and 11330 of the specifications (all sections of the specifications shall apply except for the site specific requirements)
- Confirm that QA/QC testing activities associated with the rental modular air stripping treatment unit are conducted by the subcontractor in accordance with the QA/QC requirements summarized in Table 3-1.

3.2.5 Groundwater Pumping Systems in Seven Existing Recovery Wells

Groundwater pumping systems shall be provided and installed in seven (7) existing recovery wells. Each system shall include a stainless steel submersible well pump capable of delivering 30 gpm at 110 ft TDH (Grundfos Model 25S10-7 or equal). The pump shall be installed with 1½-inch stainless steel riser pipe, well seal, and level control electrodes. A locking and weather tight control panel shall be installed near each well head. The control panel shall contain the pump motor starter, level relay, on-off-auto switch, and running indicator light. Electrical power for each pump shall be provided from the treatment unit as described in the task for modular treatment units.

QA/QC activities that are related to this task include:

- Confirm that the groundwater pumping system, including pump, riser pipe, well seal, level sensors, and control panel, is installed in accordance with the RFQ and subcontractor's proposal as approved by IT

- Verify that electrical power for the pump is provided from the treatment units as indicated and power wires and control are installed in accordance with the RFQ and subcontractor's proposal as approved by IT
- Confirm that all required submittals from the subcontractor be submitted in a timely manner and be complete as indicated in the RFQ and subcontractor's proposal as approved by IT, including but not limited to the following items: data, drawings, instructions, schedules, statements, reports, certificates, samples, records, and operation and maintenance manuals
- Confirm that QA/QC testing activities associated with the groundwater pumping systems in the existing recovery wells are conducted by the subcontractor in accordance with the QA/QC requirements summarized in Table 3-1.

3.2.6 Long-Term Modular Air Stripping Treatment Units

Five modular air stripping units shall be installed at the northern end of White Settlement Road. These units are needed for long-term groundwater remediation purposes. Each unit skid shall be securely mounted on the asphalt pavement with cinch-anchors. The influent and discharge of each treatment unit shall be connected to the collection and discharge pipe systems as described previously. Valves shall be provided to balance the flow to each unit.

These modular air stripping treatment units shall be capable of treating 30 gpm each. Each unit shall include a two-stage low profile air stripper, blower, sump, transfer pump, bag filter, 1000-pound steel carbon canister, and initial charge of virgin liquid phase granular activated carbon. The skid mounted units shall be predesigned, prepiped, prewired, and pretested in the shop. Each unit shall include an individual control panel and all electrical, control, and instrumentation components required to operate each unit independently. The skid of each unit shall provide containment for the total volume of all vessels on the skid.

Electrical power for the treatment units shall be connected from the same power source identified by Air Force Base Plant 4 personnel for the treatment unit. Electrical power wires for each recovery well shall be pulled through the conduit as described previously. Control wires from the treatment units to the recovery wells shall also be pulled through the existing conduit. Control shall be provided to shut down all the recovery wells if there is low air flow through any air stripper or if there is a high level in any air stripper sump.

Prior to installation, the subcontractor shall submit Piping and Instrumentation Diagram (P&ID) for the treatment unit, including performance specifications for each component of the treatment unit, and shop drawings of the treatment unit showing the skid size, the component layout on the skid, the control panel, and the containment. The drawings shall provide sufficient detail for review by IT Corp, USACE - Tulsa, and Air Force Base Plant 4. The drawings shall also provide sufficient detail for the acquisition of operating permits from the regulatory agencies. The drawings will be approved by IT before being issued for fabrication.

QA/QC activities that are related to this task include:

- Verify that, prior to installation, the subcontractor have submitted P&ID for the treatment unit, including performance specifications for each component of the treatment unit, and shop drawings of the treatment unit showing the skid size, the component layout on the skid, the control panel, and the containment
- Confirm that the drawings contain sufficient details for review by IT Corp, USACE - Tulsa, and Air Force Base Plant 4, and the drawings provide sufficient details for the acquisition of operating permits from the regulatory agencies
- Confirm that written approvals from IT have been issued to the subcontractor prior to fabrication of the treatment units
- Inspect and verify that, upon receipt of approvals from IT, the modular air stripping treatment units are delivered as predesigned, prepiped, prewired, and pretested complete packages, consisting of low-profile air stripper, blower, sump, transfer pump, bag filter, steel carbon canister, initial charge of virgin liquid phase granular activated carbon, and electrical and instrumentation for each unit, in accordance with the approved subcontractor's plans and specifications
- Verify that the modular air stripping units are installed at location(s) as approved and are securely mounted on the asphalt pavement with cinch-anchors
- Confirm that each unit is provided with containment for the total volume of all vessels on the skid
- Verify that the influent and discharge of the treatment unit are connected to the collection and discharge pipe systems as indicated on the attached plans
- Verify that valves are provided to balance the flow to each unit
- Verify that electrical power for the modular treatment units is connected from power source(s) as identified by Air Force Base Plant 4 personnel and power

wires and control are installed in accordance with the approved subcontractor's plans and specifications

- Confirm that all required submittals from the subcontractor be submitted in a timely manner and be complete as indicated in the RFQ and subcontractor's proposal as approved by IT, including but not limited to the following items: data, drawings, instructions, schedules, statements, reports, certificates, samples, records, and operation and maintenance manuals
- Inspect and confirm that the air stripper, transfer pump, blower, bag filter, and carbon canister are in conformance with Sections 11301, 11211, 11310, 11320, and 11330 of the specifications (all sections of the specifications shall apply except for the site specific requirements)
- Confirm that QA/QC testing activities associated with the modular air stripping treatment units are conducted by the subcontractor in accordance with the QA/QC requirements summarized in Table 3-1.

3.2.7 Fence for Groundwater Treatment Units

Upon erection of the modular treatment units, a six-foot chain link fence shall be installed around the area (estimated 50 feet by 25 feet) encompassing the treatment units and related equipment and devices. The fence shall be completed with 3 strands of barbed wire around the top and vision barriers in the fence. A 25-foot-wide gate shall be installed at one end and a manway gate on the opposite end. In addition, the fence will be marked on each side with twelve (12) of the following signs:

U.S. Government Property
Do Not Enter
Wastewater Treatment Facility
Danger
High Voltage

QA/QC activities that are related to this task include:

- Inspect and verify that the fence and accessories are installed in accordance with the subcontractor's proposal as approved by IT
- Confirm that keys to the gates are duplicated and distributed to approved personnel and records are maintained on file

- Confirm that all submittals from the subcontractor be submitted in a timely manner and be complete as indicated in the subcontractor's proposal as approved by IT, including but not limited to the following items: data, drawings, instructions, schedules, statements, reports, certificates, samples, records, and operation and maintenance manuals
- Confirm that QA/QC testing activities associated with the fence and accessories are conducted by the subcontractor in accordance with the QA/QC requirements summarized in Table 3-1.

3.2.8 Operation and Maintenance for Groundwater Treatment Units

Operation and maintenance (O&M) of the rental treatment unit, long-term modular treatment units, and recovery wells shall be conducted on a regular basis. The O&M activities shall include visual inspection and adjustments as necessary to properly operate the system. In addition, the O&M activities shall include the collection of samples as required by the permitting agencies. The liquid phase activity carbon shall be replaced based on an estimated usage rate, or on an as needed basis. The analysis of samples or the disposal cost for the spent activity carbon will be performed by IT and/or subcontractor other than the groundwater treatment subcontractor.

QA/QC activities that are related to this task include:

- Verify that O&M activities of the treatment unit are performed weekly, or as necessary, by the subcontractor in accordance with the subcontractor's proposal as approved by IT
- Confirm that O&M activities of the modular treatment units are performed weekly, or as necessary, by the subcontractor in accordance with the subcontractor's proposal as approved by IT
- Confirm that any necessary repairs, either covered under warranty or considered extra, to the modular treatment units are performed in accordance with the subcontractor's proposal upon review and approval from IT
- Confirm that samples (including regular samples and quality assurance samples) of the effluent from the treatment unit(s) are properly collected on a weekly basis, or as required by the POTW, in accordance with the subcontractor's proposal as approved by IT, and are submitted to the designated laboratory for analysis

- Collect, review and verify that the laboratory results are properly reported and distributed to the appropriate personnel in IT, USACE, Air Force Base Plant 4, and POTW
- Perform quarterly inspections of the groundwater pumping and treatment system to verify the integrity of the fence and accessories, treatment units, and collection and discharge systems over the O&M period
- Verify that the activated carbon in either the rental treatment unit or the modular treatment units are replaced as needed, but shall not be more than one year, to ensure the continued successful operation of groundwater remediation
- Confirm that all submittals from the subcontractor be submitted in a timely manner and be complete as indicated in the subcontractor's proposal as approved by IT, including but not limited to the following items: data, drawings, instructions, schedules, statements, reports, certificates, samples, records, and operation and maintenance manuals
- Confirm that QA/QC testing activities associated with the fence and accessories are conducted by the subcontractor in accordance with the QA/QC requirements summarized in Table 3-1.

TABLE 3-1

QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Below Grade Groundwater Collection Pipe and Electrical Conduit	Trench excavation (Sec. 02222)	Visual inspection during excavation and prior to backfilling	Continuous inspection during and after construction until final acceptance	Safety caution devices; Utility marking; Stockpiling of satisfactory material; Removal/disposition of unsatisfactory material; Lines & grades; Trench width, depth & slope; Shoring; Bottom preparation; Material suitability; Dewatering - Confirming to specifications	Data; Drawings; Statements; Reports; Records
	Pipe bedding, initial backfill, and final backfill (Sec. 02222)	Visual inspection during pipe bedding, initial backfill, and final backfill	Continuous inspection during and after construction until final acceptance	Material suitability; Tamping/compaction equipment; Backfill height and width; Backfilling and pressure test; Layer thickness; Compaction efforts; Pipe displacement; Pipe marking - Confirming to specifications	Data; Drawings; Schedules; Statements; Reports; Records (test reports to be submitted within 24 hours of the completion of the test)
		Inspection of testing facility(ies)	Initial inspection and follow-up inspections if needed	Inspection and approval by IT	
		Material Classification - ASTM D 2487	One test per material type	Satisfactory materials as indicated in ¶ 2.1 of Sec. 02222	
		Particle Size Analysis - ASTM D 422	One test per material type	Select granular material, initial backfill material, or final backfill material as defined in ¶ 2.1 of Sec. 02222	
		Moisture/Density Relations - ASTM D 698	One determination per 100 cubic yards of material used	Review and approval by IT	

TABLE 3-1

QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Below Grade Groundwater Collection Pipe and Electrical Conduit (cont.)	Pipe bedding, initial backfill, and final backfill (Sec. 02222) (cont.)	Field In-place Density - ASTM D 1556, ASTM D 2167, or ASTM D 2922	One test per lift for 50 feet of installation	At least 95 % maximum density for cohesionless soils and 90 % maximum density for cohesive soils	
		Moisture Contents - ASTM D 3017	Use when ASTM D 2922 is used	Moisture contents corresponding to the required maximum densities as specified	
		Density/Moisture Calibration Test - ASTM D 1556	One test at beginning and per material type if ASTM D 2922 is used	Results to be comparable to those determined by nuclear methods	
	Installation of PVC water pipe, electric conduit, and accessories (Sec. 02660)	Visual inspection during pipe installation and pressure testing	Continuous inspection during installation and testing until final acceptance	Pipe material and sizing; Pipe/accessories conditions; Storage of pipe and fittings; Pipe cutting; Clearance to existing sewer lines; Utility lines - Confirming to specifications, manufacturer's recommendations, and/or generally acceptable practices	Data; Drawings (as-built); Instructions (installation); Statements (hydrostatic test water disposal method & satisfactory installation); Reports (hydrostatic testing); Certificates (manufacturers of pipe and accessories); Records; O&M Manuals
		Material of pipe, couplings and fittings - ASTM D 1784, Class 12454B	Inspection as received	PVC pipe confirming to specifications	
		Dimension of pipe with specified working pressure and hydrostatic test pressure - ASTM D 1785 or ASTM D 2241	Inspection as received	Schedule 80 pipe with various pressure ratings for screw joint, elastomeric gasket joint, or solvent cement joint confirming to 1.2.1.1.1 of Sec. 02660	

TABLE 3-1

QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION ITEMS AND METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Below Grade Groundwater Collection Pipe and Electrical Conduit (cont.)	Installation of PVC water pipe, electric conduit, and accessories (Sec. 02660) (cont.)	Hydrostatic test - AWWA C900	One hydrostatic test per section upon completion, as deemed appropriate by subcontractor	Maximum working pressure and minimum hydrostatic pressure as specified in ¶ 2.1.1.1 of Sec. 02660	
		Joints, fittings and specials - ASTM D 2464 (threaded) and ASTM D 2466 or ASTM D 2467 (solvent cement jointing)	Continuous inspection during placement and hydrostatic testing	Materials and execution conforming to design, specifications and/or manufacturer's recommendations as approved by IT	
		Valves, indicator posts, valve boxes (NFPA 24), and meters (AWWA C700 for displacement or AWWA C701 for turbine)	Continuous inspection during installation until final acceptance	Valves made of PVC Schedule 80 with working pressure of 150 psi and properties and markings as specified; Indicator posts, valve boxes, and meters be provided and installed as specified	
		Pipe placing and laying - AWWA M23	Continuous inspection during installation until final acceptance	Pipe placing and laying techniques - Confirming to specifications, manufacturer's recommendations, and/or generally acceptable practices	
		Pipe jointing - threaded joints, elastomeric-gasket joints (ASTM F 477), or solvent cement joints (ASTM D 2855)	Continuous inspection during installation until final acceptance	Pipe jointing techniques - Confirming to specifications, manufacturer's recommendations, and/or generally acceptable practices	

TABLE 3-1

QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Below Grade Groundwater Collection Pipe and Electrical Conduit (cont.)	Valve pits, piping, and equipment in valve manholes (Sec. 02699)	Visual inspection during and after installation of valve pits, piping, and equipment	Continuous inspection during installation until final acceptance	Materials and equipment acceptability; Equipment identification; Asbestos prohibition; Electric work; Piping, fittings, and piping accessories suitability/ identification (ASME B31.1/MSS SP-25); Valve packing; Pressure gauges (ASME B40.1); Excavation, trenching, and backfilling; Valve pit dimensions and construction; Pipe sleeve materials and construction; Pipe support material and installation; Painting - Confirming to specifications, manufacturer's recommendations, and/or generally acceptable practices	Data (list of equipment and materials); Drawings (details); Instructions (installation); Statements (manufacturer's descriptive and technical literature); Reports (hydrostatic testing); Certificates (manufacturers of pipe and accessories); Records; O&M Manuals
	Installation of PVC electrical conduit (Sec. 02660)	Visual inspection during and after installation of PVC electrical conduit	Continuous inspection during installation until final acceptance	Piping (PVC Schedule 40), fittings, and piping accessories suitability/ identification; Excavation, trenching, and backfilling; Pipe jointing products and execution - Confirming to specifications, manufacturer's recommendations, and/or generally acceptable practices	Data (list of materials and products); Drawings (as-built); Instructions (installation); Statements (manufacturer's descriptive and technical literature); Certificates (manufacturers of pipe and accessories); Records

TABLE 3-1

QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Below Grade Groundwater Collection Pipe and Electrical Conduit (cont.)	Concrete patching and related work (Sec. 03300)	Visual inspection for surface preparation, batching, mixing, conveying, construction joints, finishing, curing, protection, and setting base plates and bearing plates	Continuous inspection during concrete placement and related work	Products and execution shall conform to specifications in ¶ 2.0 & ¶ 3.0	Data (test results of trial mix and statement for max. aggregate and all ingredients; manufacturer's literature for fiberglass reinforced plastic grating and accessories); Certificates (certified lab test reports; mill test reports for materials)
		Gradation tests for Aggregates - ASTM C 33	The first day and every other day thereafter during concrete construction	Grading requirement for coarse aggregate shall conform to size number 5, 6, 56, 57, or 67.	
		Air Content - ASTM C 173 or 231	A minimum of 1 test per day and be conducted in conjunction with the slump tests	Concrete in structures and slabs located in part or in whole within one foot below finish grade and above shall contain from 5 to 7 percent total air. Other concrete may be air entrained to produce concrete with 3 to 5 percent total air.	
		Slump - ASTM C 143	A minimum of 1 test be made on randomly selected batches of each mixture of concrete during each day's concrete placement	Slump for walls, columns, and beams shall be 2 to 4 inches; slump for foundation walls, substructure walls, footings, pavement, and slabs shall be 1 to 3 inches; slump for any structural concrete approved for placement by pumping shall be 0 to 6 inches.	

TABLE 3-1

QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Below Grade Groundwater Collection Pipe and Electrical Conduit (cont.)	Concrete patching and related work (Sec. 03300) (cont.)	Additional Air Content and Slump Tests - ASTM C 173 (or 231) & 143	Each 50 cubic yards of each type of concrete placed each day and coincide with compressive strength testing	Same as air content and slump tests described above	
		Unit Weight - ASTM C 138	On random samples taken for each 1000 cubic yards of concrete placed	The unit weight shall not vary more than 2 lb/ft ³ from the corresponding unit weight of the approved proportions	
		Strength (Cylinder sampling & test) - ASTM C 31 & 39	At least 5 strength tests for a given class of concrete for the total project (not less than once a day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls), plus an adequate number of field cured specimens	A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at another specified test age. Concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength (3500 lb/in ² @ 28-day) and no individual strength test result falls below the required strength by more than 500 lb/in ² .	

TABLE 3-1
QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Below Grade Treated Water Discharge Pipe	Installation of PVC water pipe and accessories (Sec. 02660)	Visual inspection during pipe installation and pressure testing (NOTE: test/inspection for discharge pipe shall be conducted in a same manner as for the collection pipe described previously)	Continuous inspection during placement and hydrostatic testing	Test/inspection items and acceptance criteria for discharge pipe shall be same as those for the collection pipe described previously	Data; Drawings (as-built); Instructions (installation); Statements (hydrostatic test water disposal method & satisfactory installation); Reports (hydrostatic testing); Certificates (manufacturers of pipe and accessories); Records; O&M Manuals
Groundwater Pumping System in Existing Recovery Well CAR-RW2	Installation of a groundwater pumping system in existing recovery well CAR- RW2 as specified in RFQ and subcontractor's proposal as approved by IT	Visual inspection during pumping system installation and test run	Continuous inspection during installation and test run	Submersible pump, riser pipe, well seal, level control electrodes, control panel - Conforming to RFQ and subcontractor's proposal as approved by IT	Data (calculations); Drawings (as-built); Instructions (installation); Schedules (installation); Statements (subcontractor's statements); Reports; Certificates (subcontractor's certificates); Records; O&M Manuals (O&M requirements)
				Test run(s) and performance of the system conforming to RFQ, subcontractor's proposal as approved by IT, and/or treatment unit operational requirements as approved by IT	
Rental Modular Air Stripping Treatment Unit	Delivery and installation of a modular air stripping treatment unit as specified in RFQ and subcontractor's proposal as approved by IT	Visual inspection during delivery and installation of the modular air stripping treatment unit	Continuous inspection during installation	Unit components: air stripping system, blower, sump, high/low pressure switch alarm, high/low level alarm, transfer pump, bag filter, liquid phase carbon canisters, electric control panel, coated carbon steel skid, initial charge of virgin activated carbon, and factory testing records - Conforming to subcontractor's proposal and treatment unit operational requirements as approved by IT	Data (calculations, descriptions, & factory testing documentation); Drawings (shop drawings & as-built); Instructions (installation); Schedules (installation); Statements (subcontractor's statements); Reports; Certificates (subcontractor's certificates); Records; O&M Manuals (O&M requirements)

TABLE 3-1

QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Rental Modular Air Stripping Treatment Unit (cont.)	Operation and maintenance of a modular air stripping treatment unit as specified in RFQ and subcontractor's proposal as approved by IT	Visual inspection during operation and maintenance of the modular air stripping treatment unit	Weekly inspection during operation and maintenance period	Operations of the unit; Conditions of filter and activated carbon; Maintenance activities and documentation; System performance (capacity and effluent standards) - Conforming to subcontractor's proposal and treatment unit operational requirements as approved by IT	
	Sampling the effluent as required by the permitting agency(ies) and/or POTW	Visual inspection during sampling events	During weekly sampling events	Sampling techniques and procedures; Collection of QA samples as required; Documentation of sampling and analysis forms	
	Analytical result reporting	Verification of analytical results upon receipt	Upon receipt of analytical results	Verification and evaluation of results upon receipt	
Groundwater Pumping Systems in Seven Existing Recovery Wells	Installation of groundwater pumping systems in seven existing recovery wells as specified in RFQ and subcontractor's proposal as approved by IT	Visual inspection during pumping system installation and test run	Continuous inspection during installation and test run	Submersible pump, riser pipe, well seal, level control electrodes, control panel - Conforming to RFQ and subcontractor's proposal as approved by IT	Data (calculations); Drawings (as-built); Instructions (installation); Schedules (installation); Statements (subcontractor's statements); Reports; Certificates (subcontractor's certificates); Records; O&M Manuals (O&M requirements)
				Test run(s) and performance of the system conforming to RFQ, subcontractor's proposal as approved by IT, and/or treatment unit operational requirements as approved by IT	

TABLE 3-1

QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Long-term Modular Air Stripping Treatment Units	Delivery and installation of five modular air stripping treatment units (Sec. 11211, 11301, 11310, 11320, 11330, 11340, and 11390, as applicable)	Visual inspection during delivery and installation of the modular air stripping treatment units	Continuous inspection during installation	Unit components: low-profile, two-stage air stripper with sight glass, liquid phase carbon canister, bag filter, system control module, pump, coated carbon steel skid, treated water transfer sump, regenerative blowers, initial charge of virgin activated carbon, and factory testing records - Conforming to subcontractor's proposal and treatment unit operational requirements as approved and applicable specification sections	Data (design calculations, list of equipment and materials, factory testing documentation); Drawings (Shop drawings); Instructions (installation); Schedules (installation, maintenance); Statements (quality/ performance requirements); Reports (field performance tests); Certificates (manufacturer's certificates); Records; O&M Manuals (operating instructions, maintenance instructions, list of maintenance materials/equipment/ pricing/suppliers)
	Test run and initial operation (start-up) of modular air stripping treatment units as required	Visual inspection during test run and initial operation (start-up) of the modular air stripping treatment units	Continuous inspection during test run and initial operation (start- up) period	Operations of the unit; Conditions of bag filter and activated carbon; Start-up activities and documentation; System performance (capacity, air/water ratio, mist elimination/separation efficiency, effluent standards) - Conforming to the subcontractor's proposal and treatment unit operational requirements as approved and applicable specification sections	
	Sampling the effluent as required by the permitting agency(ies) and/or POTW; Analytical result reporting	Review submittals for sampling events; Verification of analytical results upon receipt	Upon receipt of submittals for weekly sampling events; Upon receipt of analytical results	Sampling techniques and procedures, collection of QA samples as required, documentation of sampling and analysis forms; Verification and evaluation of results upon receipt	

3-21

TABLE 3-1

QA/QC INSPECTION AND TESTING PROGRAM
GROUNDWATER REMEDIATION SYSTEM INSTALLATION AND START-UP
LANDFILLS 4 AND 5 (CARSWELL), AIR FORCE BASE PLANT 4
FT. WORTH, TEXAS

WORK CATEGORY	WORK ITEMS (Spec. Section No.)	TEST/INSPECTION METHODS	TEST/INSPECTION FREQUENCY	TEST/INSPECTION ITEMS AND ACCEPTANCE CRITERIA	SUBMITTALS (project specific submittals with CQC Report)
Fence for Groundwater Treatment Units	Installation of a fence for groundwater treatment units as specified in subcontractor's proposal as approved by IT	Visual inspection during installation of the fence	Continuous inspection during installation until final acceptance	Components: 6' chain link fence with 3 strands of barbed wire, vision barriers, 25' gate, and manway - Conforming to the subcontractor's proposal as approved	Data (documentation); Drawings (as- built); Instructions (installation); Schedules (installation, O&M); Statements (Subcontractor quality & performance); Reports; Certificates (manufacturer's certificates); Records (administrative requirements); O&M Manuals (O&M requirements)
Operation and Maintenance for Groundwater Treatment Units	Weekly O&M activities for groundwater treatment units and analytical results as specified in RFQ and subcontractor's proposal as approved by IT	Review submittals for weekly O&M and sampling activities; Verification of analytical results upon receipt	Upon receipt of submittals for weekly O&M and sampling activities; Upon receipt of analytical results	Operation of the units; Conditions of bag filter and activated carbon; O&M activities report and documentation; System performance (capacity, air/water ratio, mist elimination/separation efficiency, effluent standards); Sampling techniques and procedures, collection of QA samples as required, documentation of sampling and analysis forms - Conforming to the subcontractor's proposal and treatment unit operational requirements as approved and applicable specification sections; Verification and evaluation of results upon receipt	Data (documentation); Drawings (as- built, O&M details); Instructions (O&M activities); Statements (Subcontractor quality & performance); Reports; Certificates (manufacturer's certificates); Records (administrative requirements); O&M Manuals (O&M requirements)

4.0 On-Site Documentation

Proper documentation of all site activities is an essential part of the quality control and quality assurance process. To provide evidence of satisfactory work performance, field inspection and testing results will be completely documented and filed in a timely manner.

4.1 Field Activity Daily Log

Documentation will include a daily log of construction activities, laboratory tests, survey data forms, sample collection and custody forms. The Superintendent will prepare a Field Activity Daily Log (FADL) consisting of, but not limited to, the following items:

- Identification of project name, location, date and shift
- Weather conditions, including time lost due to weather, recorded in ¼ days lost
- Description and location of work currently underway
- Equipment and personnel at work, including idle or standby time and reasons
- Description and location of areas being sampled and names of QA/QC personnel present during sampling
- Description of inspection activity
- Visitors on site, including organizations and comments
- Decisions and comments including conversations, directives, and directions for the following:
 - Acceptance or failure of inspections
 - Problems encountered and corrective actions taken
 - In-field modifications
 - Assessment of overall project quality.

All field construction and off-site laboratory verification records will be collected and maintained in the site record system. A copy of the FADL is provided in Figure 5.

4.2 Daily Construction Quality Control Report

A Construction Quality Control Report (Figure 6) will be prepared daily by the QC Representative to document all quality-related information.

5.0 Nonconformance and Corrective Action

Nonconforming items and activities are those which do not meet the project requirements, approved work procedures, or the quality control program. Nonconformance may be detected and identified by:

- Subcontractor Staff - during performance of construction operations and field inspections
- Laboratory Staff - during preparation for and performance of laboratory testing, and calibration of equipment, if needed
- QA/QC Support Staff - during review of field activity records, QA/QC reports, and laboratory results
- QC Representative - during performance of inspections.

Each nonconformance affecting quality will be documented by the personnel identifying or originating it. For this purpose a standard IT nonconformance report will be used.

Documentation will, when necessary, include:

- Description of nonconformance
- Identification of individual(s) identifying or originating the nonconformance
- Method(s) for completing corrective action and corrective action taken
- Required approval signatures for the corrective action
- Schedule for completing corrective action
- Individuals responsible for correcting the nonconformance and verifying satisfactory resolution.

Documentation will be made available to construction, laboratory, and/or quality control personnel. It is the responsibility of the QC Representative to notify appropriate personnel of the nonconformance. In addition, the USACE and/or Air Force Base Plant 4 should be notified as soon as practical of significant nonconformances which could impact the results of

the work. Completion of corrective actions for significant nonconformances should be verified by the QC Representative as part of future activities.

Any significant, recurring nonconformance should be evaluated by construction, laboratory, and/or quality control personnel to determine its cause and appropriate changes necessary to prevent future recurrence. The results of such an evaluation will be documented.

6.0 Change Control

It is imperative that a continuous, up-to-date reporting and review system be implemented for site activities. This review includes:

- Nonconformance identification, documentation and reporting
- Change documentation and approval.

Changes from the original specifications, plans, procedures, and the quality control program are allowed. Change does not constitute a nonconformance to the work, but means that original plans must be altered because of information or events that occur during construction. Request for change must be submitted by the QC Representative and be approved by the USACE and/or Air Force Base Plant 4.

Change must be documented, evaluated, and reported as necessary. It is necessary to manage change so that the actual course of the project, not the original specifications and plans, can be demonstrated and justified.

It is the responsibility of the QC Representative to appropriately document the change using the Record of Technical Change Form. A sample form is provided in Figure 7.

Documentation will be made available to the appropriate personnel (i.e., USACE and/or Air Force Base Plant 4, Project Manager, QA/QC Manager, etc.).

The effect of the change on the project should be evaluated by the appropriate personnel prior to implementation. Review and written approval must be provided for changes which affect the operations.

Following the review and approval process, notification of the change should be made to appropriate personnel.

7.0 Reporting Results

The results of QA/QC inspections and other field activities will be reported to the USACE and/or Air Force Base Plant 4 in a timely manner. Field information will be reported by the QC Representative to the QA/QC Manager and Project Manager as soon as practical. The daily Construction Quality Control Reports will be timely submitted to the project file and, upon request, to USACE and/or Air Force Base Plant 4 personnel. A copy of the Construction Quality Control Report is shown in Figure 6 of this plan.

8.0 Records Management

Specific records prepared for this project will be dependent on the contractual requirements and the scope of work. In order to provide the project staff and USACE and/or Air Force Base Plant 4 personnel efficient access to records, fixed filing categories will be maintained. The status of records will be clearly indicated so that superseded and out dated records will not be used in the completion of work activities.

8.1 Retention of Records

All records generated under this contract are the property of the USACE, except IT internal correspondences, general incoming correspondences, and any information (e.g., drawings, specifications, etc.) concerning IT proprietary technology. IT will maintain project records for a period of seven (7) years after the completion of each delivery order. If requested by the USACE, IT will transmit all original project records to the USACE. IT requests that IT be given 3 weeks from the date of notice for record transmittal so that adequate copies can be generated. The request for original project records will eliminate any professional obligation to maintain records for the seven (7) year period.

8.2 Record Filing Systems

Two files containing records for each delivery order will be maintained. Prior to the completion of a delivery order, the IT's home office files will contain all correspondences in Categories A2 through A7. The complete project files will be maintained on the project site. After completion of work activities and the closeout of the delivery order, all records will be transmitted to IT's home office.

8.3 Record Control

Control within the record management system includes receipt of records into the system, transmittal of records within and external to the system, transfer of records to storage and indication of record status (e.g., draft, preliminary, final, checked, and approved).

8.4 Record Status

Standard IT designations and practices for record status and verification (checking) shall apply. The following standard IT definitions shall apply:

- **DRAFT:** Project documents issued to the USACE or other agencies pending their approval. Draft indicates IT's internal review is complete. Draft documentation will be issued on standard IT DRAFT Paper. The status of the document shall be listed on the Letter of Transmittal.
- **PRELIMINARY:** Records indicated as preliminary indicate that IT's internal review has not been completed including verification of calculations, drawings, data verification and validation, tables, and text. PRELIMINARY shall be stamped on all drawings, tables, and data. The Letter of Transmittal will indicate the status of the records.
- **FINAL:** Final records are records that have completed the internal and external review and approval process. The Letter of Transmittal will indicate the status of these records.
- **CHECKED:** Drawings, tables, logs, and calculations will be checked using the standard IT verification procedures. The employee who performs the formal checking shall indicate by initial and date on the final record.
- **APPROVED:** Documents and records (e.g., drawings) requiring formal approval shall be signed and dated by the approver.

8.5 Record File Categories

Record filing categories are described in detail in the sections that follow.

8.5.1 Category A: Correspondence

Correspondence to the USACE and/or Air Force Base Plant 4 and suppliers and subcontractors will be generated using a fixed letter format. Additionally, these correspondences will be labeled with a serial letter to allow tracking and reference. IT will label correspondences received from the USACE and/or Air Force Base Plant 4 and suppliers and subcontractors with a serial number as well. In-house correspondence and general incoming correspondence will not be identified with a serial number. The serial numbering system is assigned in the following way; IT Project Number-five digit code-numeric sequence starting with 0001 and incremented by one for each letter transmitted or received. The five digit code designations are as follows:

- **ITCHO** indicates the correspondence to the USACE and/or Air Force Base Plant 4 was generated at IT's home office in Pittsburgh

- ITGHO indicates that the "general" correspondence (suppliers, subcontractors, etc.) was generated at IT's home office
- ITCPR indicates that the correspondence to the USACE and/or Air Force Base Plant 4 originated in the Project Office
- ITGPR indicates that the "general" correspondence was generated in the Project Office
- COIHO indicates that the incoming correspondence from the USACE and/or Air Force Base Plant 4 came to IT's home office
- COIPR indicates that the incoming correspondence from the USACE and/or Air Force Base Plant 4 came to the Project Office.

For example, 305912-ITCPR-0005 indicates the fifth letter sent to the USACE and/or Air Force Base Plant 4.

Category A is summarized as follows:

Category Designation	Serial Letter Designation	Content Examples
A1	NONE	In-House Correspondence
A2	ITCHO	Outgoing Correspondence from IT's Home Office to USACE and/or Air Force Base Plant 4
A3	ITGHO	Outgoing Correspondence from IT's Home Office to Suppliers
A4	ITCPR	Outgoing Correspondence from IT Project Office to USACE and/or Air Force Base Plant 4
A5	ITGPR	Outgoing Correspondence from IT Project Office to Suppliers
A6	COIHO	Incoming Correspondence from USACE and/or Air Force Base Plant 4 to IT's Home Office
A7	COIPR	Incoming Correspondence from USACE and/or Air Force Base Plant 4 to IT Project Office
A8	NONE	General Incoming Correspondence

In order to ensure a complete set of correspondence records are available on site and in IT's home office at Pittsburgh all serial letters sent from, or received at, the home office shall be copied to the project office (cc: Project Office files, Category A2 or A6) and all Serial Letters sent from the Project Office should be copied to IT's home office (cc: Home Office files, Category A4 or A7). Copies sent to IT's home office at Pittsburgh should be addressed to:

IT CORPORATION
Government Programs
3rd Floor, Box 801
2790 Mosside Boulevard
Monroeville, Pennsylvania 15146-2792

Copies sent to the Project Office will be sent to the Project Manager.

All incoming correspondence will be stamped with the date received.

8.5.2 Category C: Originals

Category C shall include all typed unbound copies of original documents prepared by IT including; reports, regulatory submittals, applications, specifications, proposals, etc.

Oversized tables should be folded and placed in the same folder as the report after the report has been printed. Camera-reduced copies of oversized tables should be included in the body of the report original. Category C will be organized by Submittal Description Number. For example:

Category Designation	Contents
C-SD18c	Site Health and Safety Plan
C-SD18i	CQC Plan Addenda (Task QA Plan)
C-SD18r	Demolition Plan

8.5.3 Category D: Bids, Contracts, and Specifications

This category includes copies of bids, proposals, estimates, contracts, project-specific purchase requisitions and purchase orders, wage rates, and specifications.

Category Designations	Subcategory	Contents
D-1		Delivery Order Specifications
	D-1a	Modifications and Amendments to Specifications
D-2		Original Estimate
	D-2a	Modifications and Amendments to Original Estimate
D-3		Original Estimate Pricing Justification
	D-3a	Modifications and Amendments to Original Estimate; Pricing Justification
D-4		Subcontractor Bid Request
	D-4-HTRW Code	Bid Request for HTRW Code
	D-4-HTRW Code	Bid Request for HTRW Code
D-5		Subcontractor Bid Response
	D-5-HTRW Code	Bid Response for HTRW Code; Shipping/Packing List
	D-5-HTRW Code	Bid Response for HTRW Code; Shipping/Packing List
D-6		Applicable Davis Bacon Wages
D-7		Drawings and Calculations Used for Estimating Materials (e.g., cut, fill, capillary water barrier)
D-8		Delivery Order Notice to Proceed
	D-8a	Modification Log
	D-8b	FWM #1 and Corresponding Change Order Request and Field Change Notification, if Applicable
	D-8c	FWM #2 and Corresponding Change Order Request and Field Change Notification, if Applicable

8.5.4 Category E: Field Data and Field Data Checkprints

This category includes subsurface logs, test data forms, calibration records, field activity daily logs, sample collection forms, waste handling data, waste manifests, inspection reports, instrument installation data, subcontractor data, etc. This includes information generated by the field personnel, with the exception of health and safety records.

Category Designation	Subcategory	Contents
E-1		Field Activity Daily Logs (FADLs)
E-2		Inspection Reports
E-3		Construction Test Data Forms
E-4		Sample Collection Forms
E-5		Calibration Records
E-6		Subsurface Logs
E-7		Waste Manifests
E-8		Instrument Installation Data
E-9		Subcontractor Field Data
E-10		Other Field Data

8.5.5 Category F: Calculations and Calculation Checkprints

This category includes all calculations and calculation checkprints except those developed for the estimate.

Category Designation	Subcategory	Contents
F-1		Calculation #1
	F-1a	Checkprint for Calculation #1
F-2		Calculation #2
	F-2a	Checkprint for Calculation #2

8.5.6 Category H: Submittals

This category includes copies of all final and DRAFT submittals. The category file will be arranged according to submittal requirements for each delivery order. The following format should be used:

Category Designation	Subcategory	Contents
H-1		Most up-dated copy of Submittal Status Log
	H-1-SD-18a	As-Built Records
	H-1-SD-18d	Environmental Protection Plan
	H-1-SD-18i	CQC Plan Addenda

8.5.7 Category I: Photographs

Photographs taken to document the course of work activities will be systematically filed and identified. Each photograph (or negative) is to be identified by project number, date taken, and a brief description.

8.5.8 Category K: Laboratory Data

This category includes laboratory test data and results for both field and office laboratories. In general, this will include raw data prepared by subcontracted (non-IT laboratories). IT laboratories will maintain their data in the laboratory files. This category will be used for data summaries issued by IT (Certificate of Analysis or CLP data packages), field laboratories, and subcontracted laboratories. Laboratory data includes data from geotechnical and construction/inspection testing laboratories.

Category Designations	Contents
K-1	Data reports from IT laboratories
K-2	Data reports and raw data from field laboratory
K-3	Data reports and raw data from subcontracted laboratories

8.5.9 Category L: Regulatory Submittals and Licensing and Permitting Applications

This category includes copies of documents, including response to questions, issued by IT to regulatory agencies either on behalf of the USACE and/or Air Force Base Plant 4 or IT. Also included would be regulatory submittals made by the USACE and/or Air Force Base Plant 4 using information provided by IT.

8.5.10 Category M: Reference Materials

This category includes reference materials such as drawings from others, journal articles, and reports from others.

8.5.11 Category N: Site Monitoring and Health and Safety Records

This category includes site monitoring records related to industrial hygiene such as personnel, area, and perimeter sampling and monitoring. Records should also include OSHA training and personnel health and safety training for all on-site personnel.

Category Designation	Contents
N-1	Site monitoring records
N-2	Personnel health and safety records

8.5.12 Category O: Drawing and Table Checkprints

This category includes checkprints for drawings, figures, sketches, and tables.

8.5.13 Category Q: Quality Records

This category includes quality control reports other than field inspection reports that are filed in Category E. Quality records should be arranged chronologically in each filing category.

The file shall be arranged as follows:

Category Designations	Contents
Q-1	Daily Construction Quality Control Reports
Q-2	Daily Reports to the Inspector
Q-3	Special Inspection Reports
Q-4	Non-Compliance Check-Off List and Nonconformance Reports
Q-5	Factory Inspections
Q-6	Other Quality Records

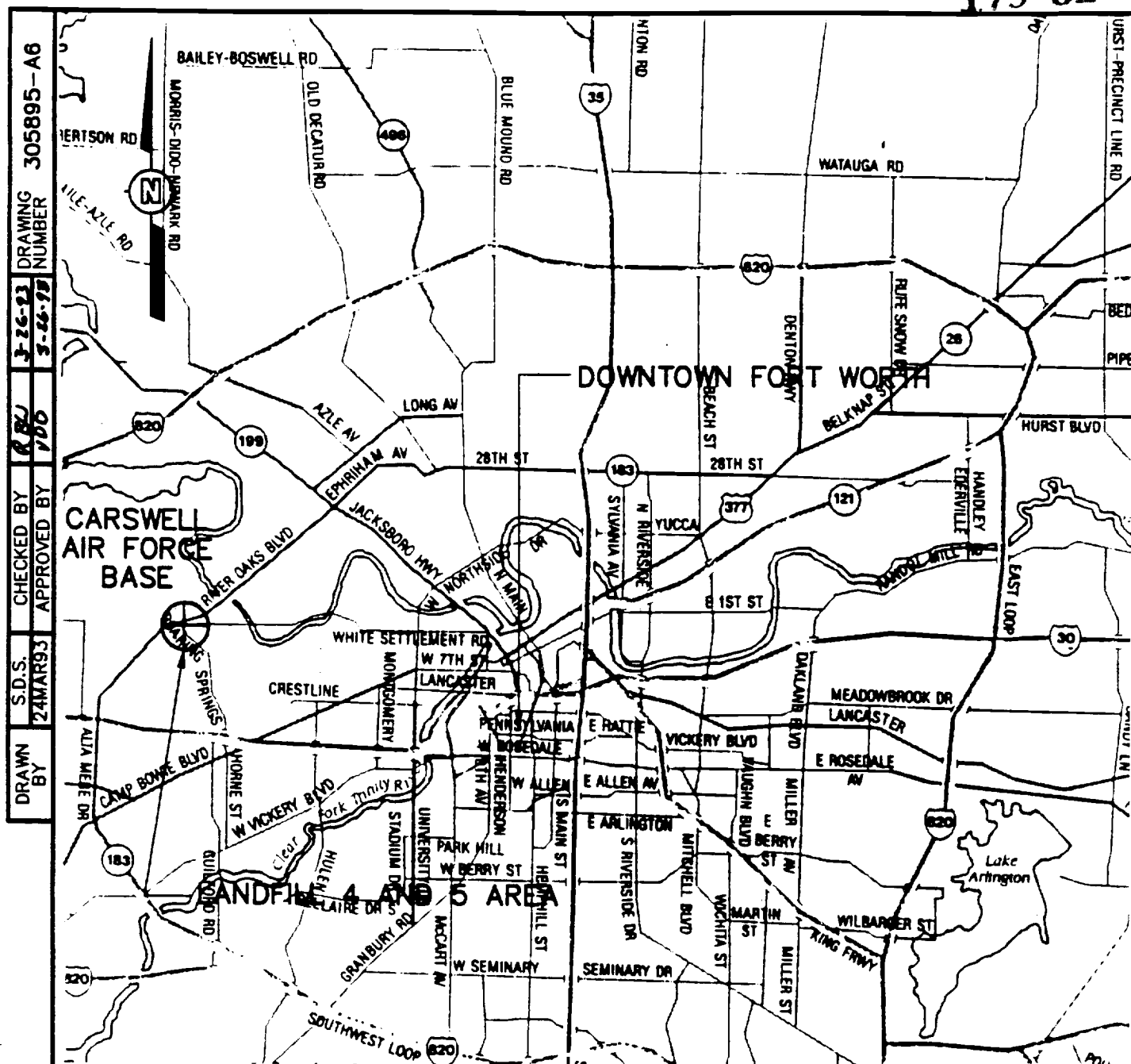
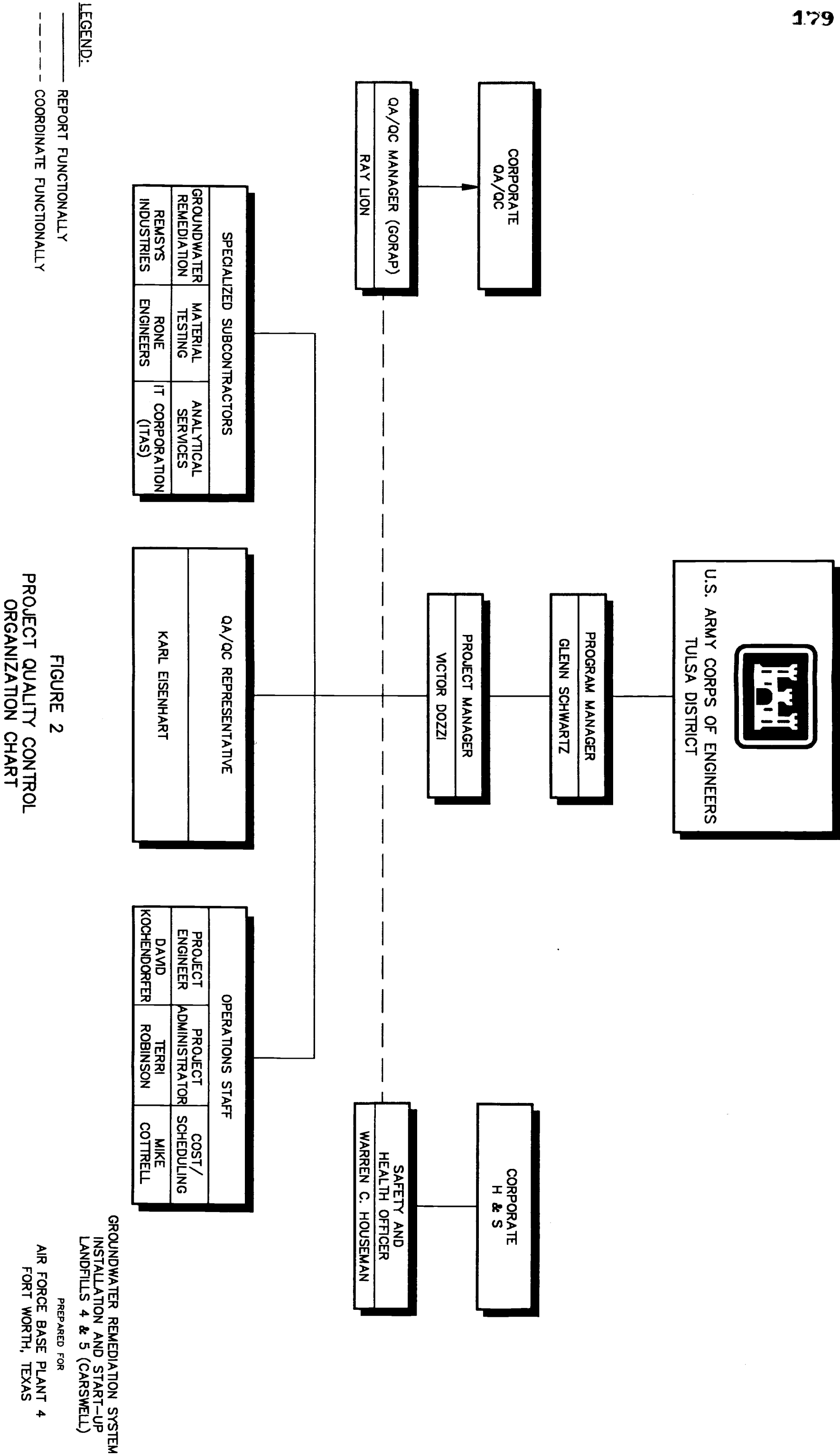


FIGURE 1
SITE LOCATION MAP

PREPARED FOR

U.S. AIR FORCE PLANT #4 (CARSWELL)
FORT WORTH, TEXAS





GROUNDWATER REMEDIATION SYSTEM
INSTALLATION AND START-UP
LANDFILLS 4 & 5 (CARSWELL)

PREPARED FOR
AIR FORCE BASE PLANT 4
FORT WORTH, TEXAS

FIGURE 4



FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE			
	NO.			
	SHEET	OF		

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
IT PERSONNEL ON SITE:	
SIGNATURE	DATE:

FIGURE 5

Report No. _____

Date: _____

DAILY CONSTRUCTION QUALITY CONTROL REPORT

USACE

Contract No. DACA56-92-D-0008

Delivery Order No. 0013

Project : GW Remediation, LF 4 and 5

Proj. No.: 305895

Proj. Loc.: Carswell Air Force Base, Ft. Worth, TX

WEATHER: () Clear () P. Cloudy () Cloudy Wind _____

Temperature: High _____ Low _____

Precipitation: Today _____ Previous Period (i.e. weekend) _____

Site Conditions: _____

Lost time Due to Inclement Weather: _____ %

PRIME CONTRACTOR/SUBCONTRACTORS AND AREAS OF RESPONSIBILITY/LABOR COUNT:

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____

WORK PERFORMED: (Indicate location and description of work performed including equipment used. Refer to work performed by prime and/or subcontractors as previously designated by letter above.) _____

MATERIALS AND/OR EQUIPMENT DELIVERED: (Include a description of materials and/or equipment, quantity, and supplier.) _____

RESULTS OF SURVEILLANCE: (Include satisfactory work completed, or deficiencies with action to be taken.)

- a. Preparatory Inspection: _____
 - b. Initial Inspection: _____
 - c. Follow-up Inspection: _____
 - d. Safety Inspection (Include safety violations and corrective actions taken): _____
- _____
- _____
- _____

QC TESTS PERFORMED AND RESULTS: (As required by scope and/or project plans.) _____

VERBAL INSTRUCTIONS RECEIVED OR GIVEN: (List any instructions received from government personnel or given by IT on construction deficiencies identified, required retesting, etc., and the corresponding action to be taken.)

CHANGED CONDITIONS/DELAYS/CONFLICTS ENCOUNTERED: (List any conflicts with the delivery order [i.e., scope and/or project plans], any delays to the project attributable to site and weather conditions, etc.) _____

MEETINGS: (List the meetings i.e., Health and Safety, Site Operations, Cost/Schedule, etc.) _____

VISITORS: (List name and affiliation). _____

REMARKS: (Any additional information pertinent to the project not defined by the previous entries.) _____

CONTRACTOR'S VERIFICATION : The above report is complete and correct.

_____ Date _____
IT QA/QC Representative

FIGURE 6 (cont.)

RECORD OF TECHNICAL CHANGE

Technical Change No. _____

Page _____ of _____

Project/Job No. _____

Date _____

Project/Job Name _____

Phase/Task _____

 The following technical changes (including justification) are requested by:

 (Name)

 (Title)

 The project time will be (Increased)(Decreased)(Unchanged) by approximately _____ days

 Applicable Project-Specific Document(s):

 CC:

 Approved By: _____ Date _____
 (Project Manager)

 _____ Date _____
 (Quality Assurance Officer)

Client Notified Yes _____ No _____ Date _____

Contract Change Order Required Yes _____ No _____

Contract Change Order No. _____

FIGURE 7

APPENDIX A

SPECIFICATIONS FOR EQUIPMENT AND WORKMANSHIP

SECTION 01010
SUMMARY OF WORK
TABLE OF CONTENTS

PART 1 - SCOPE	01010-1
PART 2 - GENERAL REQUIREMENTS	01010-2
2.1 Existing Features	01010-2
2.2 Utilities	01010-2
PART 3 - MATERIALS AND EQUIPMENT	01010-3
PART 4 - DESCRIPTION OF WORK ACTIVITIES	01010-4
4.1 Temporary Site Facilities	01010-4
4.2 Temporary Site Utilities	01010-4
4.3 Site Operational Plans	01010-4
4.4 Excavation Trenching	01010-4
4.5 Groundwater Recovery System	01010-4
4.6 Demobilization	01010-4
PART 5 - CONTRACTOR USE OF SITE	01010-5
5.1 Scope	01010-5
5.2 Contractor Responsibility	01010-5

SECTION 01010**SUMMARY OF WORK****PART 1 - SCOPE**

This section includes a brief description of the major construction activities included under this contract. Individual activities are more thoroughly described in subsequent sections of the Specifications. The Contractor shall be responsible for ensuring that sufficient equipment, labor, and materials, including health and safety and quality control provisions, are supplied to execute all work activities for final acceptance by the USACE.

PART 2 - GENERAL REQUIREMENTS

As minimum requirements, the Contractor shall observe and follow all appropriate and relevant applicable procedures identified in applicable federal, state, and local rules and regulations in conducting the work. Other applicable regulations not explicitly included in these Specifications shall be adhered to in conducting the work.

2.1 Existing Features

The Contractor shall protect and maintain structures and survey movements as directed in the field by IT and/or IT's representative against damage from equipment and vehicular traffic. Any damage shall be repaired by the Contractor at no expense to the Government and IT.

2.2 Utilities

The Contractor shall protect utility lines or appurtenances that are to remain. Utility locations have been shown on the contract drawings based on public record information and have not been field verified. It is the Contractor's responsibility to locate or verify existing utilities on site. Any damage shall be repaired by the Contractor at no expense to the Government and IT.

PART 3 - MATERIALS AND EQUIPMENT

Materials and equipment shall be provided in sufficient quantities for required construction activities. Materials and equipment shall not be stored or used in such a manner as to create unsafe conditions, and shall meet requirements of applicable codes.

PART 4 - DESCRIPTION OF WORK ACTIVITIES

The major construction activities are summarized below.

4.1 Temporary Site Facilities

If required, the Contractor shall prepare and maintain temporary site facilities, security and communication operations, and personnel and equipment decontamination facilities during the performance period of the Contract, and removal of same at the completion of contract activities. The project signs shall be installed by IT.

4.2 Temporary Site Utilities

This provision includes the operation and maintenance of all temporary site utilities, if installed, including telephone, electricity, water, and sanitation.

4.3 Site Operational Plans

IT shall develop and provide the following plans to the Contractor. The Contractor shall implement the following plans as required.

- Safety, Health, and Emergency Response Plan
- Contractor Quality Control Plan.

4.4 Excavation Trenching

Backfilling and paving activities associated with installation of all piping, conduit, valve pits, pull boxes, cleanouts, and shut-off valves.

4.5 Groundwater Recovery System

Construction of the groundwater recovery system including all piping and associated valves, conduit, pumps, valve pits, pull boxes, cleanouts, shut-off valves, electrical, and instrumentation necessary to collect and discharge groundwater to the treatment plant. The installation of extraction wells and associated electrical and instrumentation wirings will not be a part of this Contract.

4.6 Demobilization

Removal from site of all Contractor equipment, removal of temporary facilities, and temporary utilities connections, and restoration of the site to conditions equal to those at commencement of the project or to those conditions specified in the Contract.

PART 5 - CONTRACTOR USE OF SITE

5.1 Scope

The Contractor will not have complete and exclusive use of the site for execution of the work. He will share the site with the contractors for the Water Treatment Plant, in addition to the Air Force Base and USACE. The contractor is responsible for coordinating all his activities with the contractors for the Water Treatment Plant and the various military and government agencies.

5.2 Contractor Responsibility

The Contractor shall assume full responsibility for the protection and safekeeping of his equipment and materials located on site.

SECTION 01300

SUBMITTAL DESCRIPTIONS

TABLE OF CONTENTS

PART 1 - GENERAL	01300-1
1.1 Submittals	01300-1
1.1.1 Data	01300-1
1.1.2 Drawings	01300-1
1.1.3 Instructions	01300-1
1.1.4 Schedules	01300-1
1.1.5 Statements	01300-1
1.1.6 Reports	01300-2
1.1.7 Certificates	01300-2
1.1.8 Samples	01300-2
1.1.9 Records	01300-2
1.1.10 Operation and Maintenance Manuals	01300-2
PART 2 - PRODUCTS	01300-3
PART 3 - EXECUTION	01300-4

SECTION 01300**SUBMITTAL DESCRIPTIONS****PART 1 - GENERAL****1.1 Submittals**

The submittals described below are those required and further described in other sections of the specifications. Submittals required by the Contract Clauses and other nontechnical parts of the contract are not included in this section.

1.1.1 Data

Submittals which provide calculations, descriptions, or documentation regarding the work.

1.1.2 Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

1.1.3 Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

1.1.4 Schedules

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

1.1.5 Statements

A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

1.1.6 Reports

Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

1.1.7 Certificates

Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of this contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements which are being certified.

1.1.8 Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

1.1.9 Records

Documentation to record compliance with technical or administrative requirements.

1.1.10 Operation and Maintenance Manuals

Data which forms a part of an operation and maintenance manual.

PART 2 - PRODUCTS (Not Applicable)

SECTION 02222 EXCAVATION, TRENCHING, AND BACKFILLING

TABLE OF CONTENTS

PART 1 GENERAL	02222-1
1.1 References	02222-1
1.2 Payment	02222-1
1.3 Definitions	02222-2
1.3.1 Degree of Compaction	02222-2
1.4 Reports	02222-2
PART 2 PRODUCTS	02222-3
2.1 Materials	02222-3
2.1.1 Satisfactory Materials	02222-3
2.1.2 Unsatisfactory Materials	02222-3
2.1.3 Cohesionless and Cohesive Materials	02222-3
2.1.4 Rock	02222-3
2.1.5 Unyielding Material	02222-3
2.1.6 Unstable Material	02222-3
2.1.7 Select Granular Material	02222-3
2.1.8 Initial Backfill Material	02222-3
2.1.9 Plastic Marking Tape	02222-4
PART 3 EXECUTION	02222-5
3.1 Excavation	02222-5
3.1.1 Trench Excavation	02222-5
3.2 Backfilling and Compaction	02222-7
3.2.1 Trench Backfill	02222-7
3.2.2 Backfill for Appurtenances	02222-7
3.3 Special Requirements	02222-8
3.3.1 Water Lines	02222-8
3.3.2 Plastic Marking Tape	02222-8
3.4 Testing	02222-8
3.4.1 Testing Facilities	02222-8
3.4.2 Testing of Backfill Materials	02222-8
3.4.3 Field Density Tests	02222-8
3.4.4 Displacement of Sewers	02222-9

SECTION 02222**EXCAVATION, TRENCHING, AND BACKFILLING****PART 1 GENERAL****1.1 References:**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM)

ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990) Density of Soil in Place by the Sand-Cone Method
ASTM D 698	(1978; R 1990) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 2167	(1984; R 1990) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1990) Classification of Soils for Engineering Purposes
ASTM D 2922	(1981; R 1990) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.2 Payment:

The Contractor shall furnish all labor, equipment, materials, and incidentals necessary to complete the excavation trenching and backfilling. Work shall be completed in accordance with the drawings, specifications, and contract payment schedule.

All measurement and payment will be based on completed work performed in accordance with the drawings and specifications.

1.3 Definitions:

- 1.3.1 Degree of Compaction:** Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698.

1.4 Reports:

Field Density Tests/Testing of Backfill Materials: Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 Materials:

- 2.1.1 **Satisfactory Materials:** Satisfactory materials shall consist of any material classified by ASTM D 2487 as GW, GP, GM, SW, SP, SM, GC, SC, ML, CL, MH, and CH.
- 2.1.2 **Unsatisfactory Materials:** Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include, but are not limited to, those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 3 inches, and materials classified in ASTM D 2487, as PT, OH, and OL. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.
- 2.1.3 **Cohesionless and Cohesive Materials:** Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.
- 2.1.4 **Rock:** Rock shall consist of boulders measuring 1/2-cubic yard or more and materials that cannot be removed without systematic drilling and blasting such as rock material in ledges, bedded deposits, unstratified masses and conglomerate deposits, and below ground concrete or masonry structures exceeding 1/2-cubic yard in volume, except that pavements will not be considered as rock.
- 2.1.5 **Unyielding Material:** Unyielding material shall consist of rock and gravelly soils with stones greater than 3 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.
- 2.1.6 **Unstable Material:** Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.
- 2.1.7 **Select Granular Material:** Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough, and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1-inch sieve. The maximum allowable aggregate size shall be 1/4 inch, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

- 2.1.8 **Initial Backfill Material:** Initial backfill shall consist of select granular material or satisfactory materials free from rocks 1/4 inch or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.
- 2.1.9 **Plastic Marking Tape:** Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with a minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in Table 1 and shall bear a continuous printed inspection describing the specific utility.

Table 1
Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

PART 3 EXECUTION

3.1 Excavation:

Excavation shall be performed to the lines and grades indicated on the drawings. Rock excavation shall include removal and disposition of material defined as rock in Paragraph 2.1, Materials. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 of the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site or shall be disposed of accordingly. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized over excavation shall be backfilled in accordance with Paragraph 3.2, Backfilling and Compaction at no additional cost to IT and the Government.

3.1.1 Trench Excavation: The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 4 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D) for pipes of less than 24 inches inside diameter (I.D). Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to IT and the Government.

3.1.1.1 Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 1/4 inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.2 Removal of Unyielding Material: Where (overdepth is not indicated and) unyielding material is encountered in the bottom of the trench,

such material shall be removed 4 inches below the required grade and replaced with suitable materials as provided in Paragraph 3.2, Backfilling and Compaction.

- 3.1.1.3 **Removal of Unstable Material:** Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in Paragraph 3.2, Backfilling and Compaction. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to IT and the Government.
- 3.1.1.4 **Excavation of Appurtenances:** Excavation for valve pits, pull boxes, shut-off valves, clean-outs, or similar structures shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.
- 3.1.1.5 **Jacking, Boring, and Tunneling:** Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of IT, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.
- 3.1.1.6 **Stockpiles:** Stockpiles of satisfactory, unsatisfactory, and wasted materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well-drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment. Excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to IT and the Government. Locations of stockpiles of satisfactory materials shall be subject to prior approval of IT and IT's representative.

3.2 Backfilling and Compaction:

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand-operated machine compactors, and 8 inches loose thickness for other than hand-operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

3.2.1 Trench Backfill: Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 2 feet above the top of pipe prior to performing the required pressure test. The joints and couplings shall be left uncovered during the pressure test.

3.2.1.1 Replacement of Unyielding Material: Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

3.2.1.2 Replacement of Unstable Material: Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers no exceeding 6 inches loose thickness.

3.2.1.3 Bedding and Initial Backfill: Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least 1 foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Compaction of initial backfill will be to 95 percent maximum density for cohesionless soils and a minimum of 90 percent maximum density for cohesive soils.

3.2.1.4 Final Backfill: The remainder of the trench shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

Backfill shall be deposited in layers of a maximum of 12-inch loose thickness, and compacted to a minimum 90 percent maximum density for cohesive soils and a minimum of 95 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designed above.

3.2.2 Backfill for Appurtenances: After the valve pit, pull box, shut-off valve, clean-out, or similar structure has been constructed, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill

and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 Special Requirements:

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.3.1 **Water Lines:** Trenches shall be of a depth to provide a minimum cover of 18 inches from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.3.2 **Plastic Marking Tape:** Warning tapes shall be installed directly above the pipe, at a depth of 12 inches below finished grade unless otherwise shown.

3.4 Testing:

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to IT and the Government

3.4.1 **Testing Facilities:** Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by IT. The first inspection shall be at the expense of IT and the Government. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

3.4.2 **Testing of Backfill Materials:** Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils (ASTM D 422) and moisture-density relations of soils (ASTM D 698). A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

3.4.3 **Field Density Tests:** Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 50 feet of installation shall be performed. One moisture density relationship shall be determined for every 100 cubic yards of material used. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using the sand cone method. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by IT. Copies of calibration curves, results of calibration tests, and

field and laboratory density tests shall be furnished to the IT. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to IT and the Government.

- 3.4.4 Displacement of Sewers: After other required tests have been performed and the trench backfill compacted to a minimum of 18 inches above the top of the pipe (the finished grade surface), the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the IT. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe.

If, in the judgment of the IT, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to IT and the Government.

1.0 General

The work covered under this specification includes construction of concrete containments for furnishing of all labor, equipment and materials, and in performing testing associated with the placement of concrete for floor slabs, equipment foundations, grade beams, and other miscellaneous foundations, drainage structures, sumps, and other miscellaneous structures to be made of cast-in-place concrete. For all test methods, the most recent revision to the standard method shall be used.

1.1 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICES (AASHTO)
M182-60	Burlap Cloth Made of Jute or Kenaf
	AMERICAN CONCRETE INSTITUTE (ACI)
ACI 117	(1990) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1989) Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 301	(1989) Structural Concrete for Buildings
ACI 305R	(1989) Hot Weather Concreting
ACI 318	(1989; 318R-89) Building Code Requirements for Reinforced Concrete
	AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
ASTM C 31	(1990) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1990) Concrete Aggregates
ASTM C 39	(1986) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	(1987) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 94	(1990) Ready-Mixed Concrete
ASTM C 109	(1990) Compressive Strength of Hydraulic Cement Mortars(Using 2-in. or 50-mm Cube Specimens)
ASTM C 143	(1990) Slump of Hydraulic Cement Concrete

ASTM C 150	(1989) Portland Cement
ASTM C 171	(1969; R 1986) Sheet Materials for Curing Concrete
ASTM C 172	(1990) Sampling Freshly Mixed Concrete
ASTM C 173	(1978) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192	(1990a) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1989a) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1986) Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	(1989) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	(1986) Chemical Admixtures for Concrete
ASTM C 552	(1988) Cellular Glass Thermal Insulation
ASTM C 578	(1987a) Preformed, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1985) Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation
ASTM C 595	(1989) Blended Hydraulic Cements
ASTM C 597	(1983) Pulse Velocity Through Concrete
ASTM C 618	(1989a) Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 803	(1990) Penetration Resistance of Hardened Concrete
ASTM C 805	(1985) Rebound Number of Hardened Concrete
ASTM C 989	(1989) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1017	(1985) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1107	(1989a) Packaged Dry, Hydraulic-Cement Grout (Nonshrinkable)
ASTM D 98	(1987) Calcium Chloride
ASTM E 96	(1990) Water Vapor Transmission of Materials
	FEDERAL SPECIFICATIONS (FS)
FS CCC-C-467	(Rev C) Cloth, Burlap, Jute (or Kenaf)

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA-QC 3 (Jan 1984; 4th Rev) Quality Control Manual: Section 3, Plant
Certifications Checklist: Certification of Ready-Mixed Concrete
Production Facilities

NRMCA CPMB-100 (Jan 1990; 9th Rev) Concrete Plant Standards

NRMCA TMMB-1 (1989; 13th Rev) Truck Mixer and Agitator Standards

1.2 Submittals

The following shall be submitted before placement of concrete will be permitted to be started:

- The results of trial mix along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the concrete is satisfactory.
- Certified copies of laboratory test reports, including all test data, for aggregate, admixtures, and curing compound. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials.
- Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished, for cement, pozzolan, and ground iron blast-furnace slag. No cement, pozzolan, or slag shall be used until notice of acceptance has been given. Cement, pozzolan, and slag may be subjected to check testing by the QC Engineer from samples obtained at the mill, at transfer points, or at the project site.
- Manufacturer's published literature for fiberglass reinforced plastic grating and accessories including specifications, physical characteristics, and performance data.

1.3 General Requirements

Tolerances for concrete construction and materials shall be in accordance with ACI 117.

1.3.1 Strength Requirements

Structural concrete for all work shall have a 28-day minimum compressive strength of 3500 pounds per square inch. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement.

1.3.2 Air Entrainment

Concrete in structures and slabs located in part or in whole within one foot below finish grade and above shall contain from 5 to 7 percent total air. Other concrete may, at the option of the Contractor, be air entrained to produce concrete with 3 to 5 percent total air.

1.3.3 Special Properties

Concrete may contain other admixtures, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if approved.

1.3.4 Slump

Slump shall be within the following limits:

<u>Structural Element</u>	<u>Slump in Inches</u>	
	<u>Minimum</u>	<u>Maximum</u>
Walls, columns, and beams	2	4
Foundation walls, substructure walls, footings, pavement, and slabs	1	3
Any structural concrete approved for placement by pumping	None	6

*Where use of superplasticizers are approved to produce flowing concrete these slump requirements do not apply.

1.4 Weather Limitations

Placement of concrete shall not be initiated during a rain shower. If a rain shower begins during concrete placement, the operation will be terminated at the direction of the QC Engineer. Concrete already in transit shall be permitted to be placed and bulk heads shall be

constructed to form a cold joint as directed in Section 03250 EXPANSION JOINTS CONTRACTION JOINTS AND WATERSTOPS.

Placement during cold weather shall only be permitted if the contractor has enough insulation material on site to ensure that the surface temperature of the concrete will not fall below 58 degrees Fahrenheit (°F) during the curing period.

2.0 Products

Materials included in all concrete mixtures shall conform to the following provisions.

2.1 Admixtures

Admixtures shall conform to the following:

2.1.1 Accelerating Admixture

Admixture used to accelerate the set time of the concrete shall conform to ASTM C 494, Type C or calcium chloride conforming to ASTM D 98.

2.1.2 Air-Entraining Admixture

Admixtures used to increase the amount of entraining air in the concrete shall conform to ASTM C 260.

2.1.3 Flowing Concrete Admixture

Plasticizers, superplasticizers, and other admixtures that increase the flowability of the concrete shall conform to ASTM C 1017, Type 1 or 2.

2.1.4 Water-Reducing or Retarding Admixture

Plasticizers, superplasticizers and other admixtures that decrease the amount of water required for the concrete mixture and admixtures that increase the set time for the concrete shall conform to ASTM C 494, Type A or D.

2.2 Cementitious Materials

Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall conform to one of the following:

2.2.1 Cement

Cement used in the concrete mix shall conform to ASTM C 150, Type I.

2.2.2 Portland Blast-Furnace-Slag Cement

Portland Blast-Furnace-Slag Cement shall conform to ASTM C 595, Type IS-MS and shall be used only if ground iron blast-furnace slag is used as the coarse aggregate in the concrete mix. Portland blast-furnace-slag cement may only be used if approved by the QC Engineer.

2.2.3 Portland-Pozzolan Cement

Portland-Pozzolan Cement shall conform to ASTM C 595, Type IP-MS and may be used in the concrete mix if approved of the contracting officer. Portland-Pozzolan Cement shall be required if a pozzolan is used in the concrete mix, and shall only be used if a Pozzolan is used in the concrete mix.

2.2.4 Pozzolan

Pozzolan shall conform to ASTM C 618, Class F, C, or N, and shall only be used with Portland-Pozzolan Cement, if approved.

2.2.5 Ground Iron Blast-Furnace Slag

Ground iron from a blast furnace shall conform to ASTM C 989, Grade 120, and shall only be used with Portland Blast-Furnace-Slag Cement in the concrete mix, if approved.

2.3 Aggregates

Aggregates shall be normal weight aggregate and conform to ASTM C 33. Grading requirement for coarse aggregate shall conform to size number 5, 6, 56, 57, or 67.

2.4 Curing

Curing materials shall conform to the following:

2.4.1 Burlap

Burlap supplies for curing of concrete shall conform to FS CCC-C-467 or AASHTO designation M 182, Class 3.

2.4.2 Impervious Sheets

Plastic sheeting supplies for curing shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.4.3 Combined Burlap and White Polyethylene Sheeting

Burlap that has white polyethylene sheeting permanently bonded to it, if used, shall be saturated with water at the time of placement.

2.4.4 Membrane-Forming Compounds

Compounds that form membranes shall conform to ASTM C 309, Type 1-D, Class A or B or AASHTO Designation M 182, Class 3 and shall be of a formula suitable for the special application.

2.4.5 Water Proof Paper

Water proof paper supplies for curing shall conform to ASTM C 171.

2.5 Nonshrink Grout

Nonshrink grout shall conform to ASTM C 1107 and shall be a formulation suitable for the application.

2.6 Vapor Barrier

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 6 mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E 96.

2.7 Water

Water shall be potable, except that nonpotable water may be used if it produces mortar cubes having 7- and 28-day strengths at least 90 percent of the strength of similar specimens made with water from a municipal supply. The strength comparison shall be made on mortars, identical except for mixing water, prepared and tested in accordance with ASTM C 109. Water for curing shall not contain any substance injurious to concrete, or which causes staining.

3.0 Execution

Operations associated with concrete placement and finishing shall be performed to conform to the following provisions.

3.1 Preparation of Surfaces

Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Conduit and other similar items shall be in place and clean of any deleterious substance.

3.1.1 Foundations

Earthwork shall be completed in accordance with Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS. The subcontractor shall be responsible for the placement and preparation of geotextile, flexible membrane liner (FML) and stone subbase materials as described in Section 02711-01 GEOSYNTHETICS, FLEXIBLE MEMBRANE LINER, and Section 02234 SUBBASE COURSE of these specifications. Flowing water shall be diverted without washing over freshly deposited concrete. Rock foundations shall be cleaned by high velocity air-water jets, sandblasting, or other approved methods. Debris and loose, semi-detached or unsound fragments shall be removed. Rock surfaces shall be moist but without free water when concrete is placed. Semiporous subgrades for foundations and footings shall be damp when concrete is placed. Pervious subgrades shall be sealed by blending impervious material with the top 6 inches of the in-place pervious material or by covering with an impervious membrane.

3.2 Installation of Embedded Items

Embedded items shall be free from oil, loose scale or rust, and paint. Embedded items shall be installed at the locations indicated and required to serve the intended purpose. Voids in sleeves, slots and inserts shall be filled with readily removable material to prevent the entry of concrete.

3.3 Batching, Mixing, and Transporting Concrete

Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating units shall comply with NRMCA TMMB-1. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA-QC 3. Site-mixed concrete shall be mixed in accordance with ACI 301. On-site plant shall conform to the NRMCA CPMB-100.

3.3.1 Admixtures

Admixtures shall be batched within an accuracy of 3 percent. Where two or more admixtures are used in the same batch, they shall be batched separately and must be compatible.

Retarding admixture shall be added within one minute after addition of water is complete or in the first quarter of the required mixing time, whichever is first. Superplasticizing admixtures shall be added at the project site, and the concrete with the admixture shall be mixed 4 to 5 minutes before placing or as recommended by manufacturer of the superplasticizer. Concrete that shows evidence of total collapse or segregation caused by the use of admixture shall be removed from the site.

3.3.2 Control of Mixing Water

No water from the truck system or elsewhere shall be added after the initial introduction of mixing water for the batch except when on arrival at the jobsite, the slump of the concrete is less than that specified. Water added to bring the slump within the specified range shall not change the total water in the concrete to a point that the approved water-cement ratio is exceeded. The drum shall be turned an additional 20 to 30 revolutions, if necessary, until the added water is uniformly mixed into the concrete. Water shall not be added to the batch at any later time.

3.4 Sampling and Testing

Sampling and Testing is the responsibility of the Contractor and shall be performed by an approved testing agency.

3.4.1 Aggregates

Aggregates for normal weight concrete shall be sampled and tested in accordance with ASTM C 33. Gradation tests shall be performed on the first day and every other day thereafter during concrete construction.

3.4.2 Sampling of Concrete

Samples of concrete for air, slump, unit weight, and strength tests shall be taken in accordance with ASTM C 172.

3.4.2.1 Air Content

Test for air content shall be performed in accordance with ASTM C 173 or ASTM C 231. A minimum of 1 test per day shall be conducted and the tests shall be conducted in conjunction with the slump tests.

3.4.2.2 Slump

At least 1 slump test shall be made on randomly selected batches of each mixture of concrete during each day's concrete placement. Tests shall be performed in accordance with ASTM C 143. Additional slump tests may be ordered if any single batch appears to have a significantly different consistency than the previous batches or if water is added to the batch after arrival on site.

3.4.2.3 Frequency of Testing

A minimum of 1 test each for air content and slump shall be conducted during each day's placement of each type of concrete. If placement time exceeds a total of 4 consecutive hours or if more than 2 hours time elapses between delivery of consecutive batches of concrete to the site an additional set of air content and slump tests shall be performed.

Air content and slump tests shall be performed on each 50 cubic yards of each type of concrete placed each day and shall coincide with sampling for compressive strength testing. These air content and slump tests shall be in addition to the tests required above.

3.4.2.4 Unit Weight

Test for unit weight of concrete shall be performed in accordance with ASTM C 138. Tests shall be conducted on random samples taken for each 1000 cubic yards of concrete placed. The unit weight of fresh concrete shall not vary more than 2 pounds per cubic foot from the corresponding unit weight of the approved proportions.

3.4.3 Evaluation and Acceptance of Concrete

After placement and curing concrete will be evaluated for acceptance based on the following criteria:

3.4.3.1 Frequency of Testing

Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls. Tests for air content and slump shall be conducted in conjunction with each set of samples taken for strength tests. If this sampling frequency results in less than 5 strength tests for a given class of concrete for the total project, tests shall be made from at least 5 randomly selected trucks or from each truck if fewer than 5 truck loads are used. Field cured specimens for determining form removal time or when a structure may be put in service shall be made in numbers directed to check the adequacy of curing and protection of concrete in the structure. The specimens shall be removed from the molds at the age of 24 hours and shall be cured and protected, insofar as practicable, in the same manner as that given to the portion of the structure the samples represent.

3.4.3.2 Testing Procedures

Cylinders for acceptance tests shall be molded and cured in accordance with ASTM C 31. Cylinders shall be tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at another specified test age.

3.4.3.3 Evaluation of Results

Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength and no individual strength test result falls below the required strength by more than 500 pounds per square inch.

3.4.4 Investigation of Low-Strength Test Results

When any strength test of standard-cured test cylinder falls below the specified strength requirement by more than 500 pounds per square inch, or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized. Nondestructive testing in accordance with ASTM C 597, ASTM C 803 or ASTM C 805 may be permitted to determine the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other

test data, shall not be used as a basis for acceptance or rejection. When strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined prior to coring to least impair the strength of the structure. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80°F, relative humidity less than 60 percent) for seven days before testing and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C 42. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to or at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. If the core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be directed in accordance with the requirements of ACI 318. Concrete work evaluated by structural analysis or by results of a load test and found deficient shall be corrected in a manner satisfactory to the QC Engineer. All investigations, testing, load tests, and correction of deficiencies shall be performed, and approved by the QC Engineer, at the expense of the Contractor.

3.5 Conveying Concrete

Concrete shall be conveyed from mixer to forms as rapidly as possible and within the time interval specified in paragraph CONCRETE PLACEMENT by methods which will prevent segregation or loss of ingredients.

When concrete can be placed directly from a truck mixer or other transporting equipment, chutes attached to this equipment may be used. Separate chutes will not be permitted except when specifically approved.

3.6 Concrete Placement

Mixed concrete which is transported in truck mixers or agitators or concrete which is truck mixed, shall be discharged within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. These limitations may be waived by the QC Engineer if the concrete is of such slump after the 1-1/2 hour time or 300

revolution limit has been reached that it can be placed, without the addition of water to the batch. When the concrete temperature exceeds 85°F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the truck.

3.6.1 Placing Operation

Concrete shall be handled from mixer to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 8 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level to avoid excessive shimming or grouting.

3.6.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 8000 vibrations per minute, and the head diameter and amplitude shall be appropriate for the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then withdrawn slowly. The use of form vibrators must be specifically approved. Vibrators shall not be used to transport concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation and flotation of coarse aggregate shall be avoided.

3.6.3 Warm Weather Requirements

The temperature of the concrete placed during warm weather shall not exceed 85°F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 95°F.

3.7 Construction Joints

Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the QC Engineer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete is no longer plastic, before placing concrete for beams, girders, or slabs thereon. In walls having door window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints are required, a strip of 1-inch square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph PREPARATIONS OF SURFACES.

3.8 Finishing Concrete

The surface of all concrete shall have the appropriate finish as directed on the drawings and shall conform to the following specifications.

3.8.1 Formed Surfaces

Surfaces that will remain exposed after the forms are stripped from the concrete shall be finished as follows:

3.8.1.1 Repair of Surface Defects

Surface defects shall be repaired within 24 hours after the removal of forms. Honeycombed and other defective areas shall be cut back to solid concrete or to a depth of not less than 1 inch, whichever is greater. Edges shall be cut perpendicular to the surface of the concrete. The prepared areas shall be dampened and brush-coated with neat cement grout. The repair shall be made using mortar consisting of not more than 1 part cement to 2-1/2 parts sand. The mixed mortar shall be allowed to stand to stiffen (approximately 45 minutes), during which time the mortar shall be intermittently remixed without the addition of water. After the mortar has attained the stiffest consistency that will permit placing, the patching mix shall be thoroughly tamped into place by means approved by the QC Engineer and finished slightly higher than the surrounding surface. For Class A and Class B finished surfaces the cement used in the patching mortar shall be a blend of job cement and white cement proportioned to produce a finished repair surface matching, after curing, the color of adjacent surfaces. Holes left after the removal of form ties shall be cleaned and filled with patching mortar. Holes left by the removal of tie rods shall be reamed and filled by dry-packing. Repaired surfaces shall be cured as required for adjacent surfaces. The temperature of concrete, mortar patching material, and ambient air shall be above 50°F while making repairs and during the curing period. Concrete with defects which affect the strength of the member or with excessive honeycombs will be rejected, or the defects shall be corrected as directed.

3.8.1.2 Class A Finish

Where a Class A finish is indicated, fins shall be removed. A mortar mix consisting of one part portland cement and two parts well-graded sand passing a No. 30 sieve, with water added to give the consistency of thick paint, shall be prepared. White cement shall be used to replace part of the job cement. After the surface has been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by clean burlap pads or by cork or wood-floating, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads until all visible grout film is removed. The rubbing pads shall have on their surfaces the same sand-cement mix specified above but without any mixing water. The finish of any area shall be completed in the same day, and the limits of a finished area shall be made at natural breaks in the surface. The surface shall be continuously moist cured for 48 hours. The temperature of the air adjacent to the surface

shall be not less than 50°F for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas.

3.8.1.3 Class B Finish

Where a Class B finish is indicated, fins shall be removed. Concrete surface shall be smooth with a texture at least equal to that obtained through the use of Grade B-B plywood forms.

3.8.1.4 Class C Finish

Where a Class C finish is indicated, fins shall be removed. Concrete surfaces shall be relatively smooth with a texture imparted by the forms used.

3.8.1.5 Class D Finish

Where a Class D finish is indicated, fins exceeding 1/4 inch in height shall be chipped or rubbed off. Concrete surfaces shall be left with the texture imparted by the forms used.

3.8.2 Unformed Surfaces

In hot windy weather when the rate of evaporation of surface moisture, as determined by methodology presented in ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour; coverings, windbreaks, or fog sprays shall be provided as necessary to prevent premature setting and drying of the surface. The dusting of surfaces with dry materials or the addition of water during finishing will not be permitted. Finished surfaces shall be plane, with no deviation greater than 1/2 inch when tested with a 10-foot straightedge. Surfaces shall be pitched to drains. Unformed surfaces shall have the finish completed on the same day as the concrete placement except for floor hardener.

3.8.2.1 Rough-Slab Finish

Slabs to receive fill or mortar setting beds shall be screeded with straightedges immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible.

3.8.2.2 Float Finish

All slabs shall be given a float finish. Screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. After the concrete has stiffened to permit the operation and the water sheen has disappeared,

it shall be wood floated. Concrete that portrays stickiness shall be finished with a magnesium float in lieu of a wood float, and left free of ridges and other projections.

3.8.2.3 Trowel Finish

Slabs, where indicated on the drawings, shall be given a trowel finish immediately following floating. Surfaces shall be trowelled to produce smooth, dense slabs free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. A final hard steel troweling shall be done by hand.

3.8.2.4 Broom Finish

After floating, slabs where indicated on the drawings, shall be lightly trowelled, and then broomed with a fiber-bristle brush in a direction transverse to that of the main traffic.

3.9 Curing and Protection

All cast-in-place concrete shall be cured to conform to the following provisions.

3.9.1 General

All concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
Concrete with Type I, II, IP, or IS cement	7 days
Concrete with Type I or Type II cement blended with pozzolan	7 days

Immediately after placement, concrete shall be protected from premature drying extremes in temperatures, rapid temperature change, mechanical injury and injury from rain and flowing water. Air and forms in contact with concrete shall be maintained at a temperature above 50°F for the first 3 days and at a temperature above 32°F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. All materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat shall be permitted near or in direct contact with

the concrete at any time. Curing shall be accomplished by any of the following methods, or combination thereof, as approved.

3.9.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period. If water or curing materials used stains or discolors concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 2-inch minimum thickness of continuously saturated sand, or by covering with waterproof paper, polyethylene sheet, polyethylene-coated burlap or saturated burlap.

3.9.3 Membrane Curing

Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete; except a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified.

Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. Surfaces shall be thoroughly moistened with water and the curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period.

Compound shall be applied in a one-coat continuous operation by mechanical spraying equipment, at a uniform coverage in accordance with the manufacturer's printed instructions. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. On surfaces permanently exposed to view, the surface shall be shaded from direct rays of the sun for the duration of the curing period. Surfaces coated with curing compound shall be kept free of foot

and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.10 Setting Base Plates and Bearing Plates

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately $1/24$ the width of the plate, but not less than $3/4$ inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed.

3.10.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and $2-1/2$ parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.10.2 Nonshrink Grout

Nonshrink grout shall be mixed and placed in accordance with material manufacturer's written recommendations. Forms of wood or other suitable material shall be used to retain the grout. The grout shall be placed quickly and continuously, completely filling the space without segregation or bleeding of the mix.

3.10.3 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 1 inch and immediately covered with a parge coat of mortar consisting of 1 part portland cement and $2-1/2$ parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

SECTION 02660

GROUNDWATER RECOVERY DISCHARGE LINES

TABLE OF CONTENTS

PART 1-GENERAL	02660-1
1.1 References	02660-1
1.2 General	02660-2
1.2.1 Piping for Groundwater Recovery Discharge Lines	02660-3
1.2.2 Excavation, Trenching, and Backfilling for Water Lines ..	02660-3
1.3 Unit Prices	02660-3
1.3.1 Payment	02660-3
1.4 Submittals	02660-3
1.5 Handling	02660-4
1.5.1 Miscellaneous Plastic Pipe and Fittings	02660-4
PART 2-PRODUCTS	02660-5
2.1 Pipe	02660-5
2.1.1 Plastic Pipe	02660-5
2.2 Fittings and Specials	02660-6
2.2.1 Polyvinyl Chloride (PVC) Pipe	02660-6
2.3 Joints	02660-6
2.3.1 Plastic Pipe	02660-6
2.4 Valves	02660-6
2.4.1 Check Valves	02660-6
2.4.4 Indicator Post for Valves	02660-7
2.5 Valve Boxes	02660-7
2.6 Valve Pits	02660-7
2.7 Miscellaneous Items	02660-7
2.7.1 Meters	02660-7
PART 3-EXECUTION	02660-8
3.1 Installation	02660-8
3.1.1 Cutting of Pipe	02660-8
3.1.2 Adjacent Facilities	02660-8
3.1.3 Joint Deflection	02660-8
3.1.4 Placing and Laying	02660-9
3.1.5 Jointing	02660-9

SECTION 02660
GROUNDWATER RECOVERY DISCHARGE LINES
PART 1-GENERAL

1.1 References:

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM)

ASTM D 1784 (1990) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D 1785 (1989) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2241 (1989) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D 2464 (1990) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2466 (1990a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D 2467 (1990) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2564 (1988) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

ASTM D 2855 (1990) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

ASTM F 477 (1976; R 1985) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

American Society of Mechanical Engineers (ASME)

ASME B1.20.1 (1983) Pipe Threads, General Purpose (Inch)

American Water Works Association (AWWA)

AWWA C700 (1990) Cold-Water Meters - Displacement Type, Bronze Main Case

AWWA C701 (1988) Cold-Water Meters - Turbine Type for Customer Service

AWWA C800 (1989) Underground Service Line Valves and Fittings

AWWA C900 (1989) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

AWWA M23 (1980) PVC Pipe - Design and Installation

National Fire Protection Association (NFPA)

NFPA 24 (1987) Installation of Private Fire Service Mains and Their Appurtenances

NFPA 49 (1975) Hazardous Chemicals Data

NFPA 325M (1991) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids

NFPA 704 (1990) Identification of the Fire Hazards of Materials

1.2 General

This section covers groundwater recovery discharge lines from the seven recovery wells to the treatment facility. Also includes the PVC conduit pipes for running electrical wires as shown on drawings. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Piping for Groundwater Recovery Discharge Lines

Piping for groundwater recovery discharge lines for sizes 3 inches in diameter and smaller shall be Schedule 80, polyvinyl chloride (PVC) plastic, unless otherwise shown or specified. The electrical and instrumentation conduits shall be PVC Schedule 40.

1.2.2 Excavation, Trenching, and Backfilling for Water Lines

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02222 Excavation, Trenching, and Backfilling for Utilities Systems, except as modified herein.

1.3 Unit Prices

Measurement and payment will be based on completed work performed in accordance with the drawings, specifications, and the contract payment schedules. No payment will be made under this section for excavation, trenching, or backfilling. Payment for such work will be made under Section 02222 Excavation, Trenching, and Backfilling for Utilities Systems.

1.3.1 Payment

The contractor shall furnish all testing, labor, equipment, materials, and incidentals necessary to complete the installation of the groundwater recovery discharge lines. The work shall be completed in accordance with the drawings, specifications, and contract payment schedules.

1.4 Submittals

1.4.1 Instructions

1.4.1.1 Installation.

The manufacturer's recommendations for each material or procedure to be utilized.

1.4.2 Statements

1.4.2.1 Waste Water Disposal Method.

The method proposed for disposal of waste water from hydrostatic tests, prior to performing hydrostatic tests.

1.4.2.2 Statement of Satisfactory Installation.

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract plans and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

1.5 Handling

Pipe and accessories shall be handled so as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to IT and the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.5.1 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

PART 2-PRODUCTS

2.1 Pipe

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 Polyvinyl Chloride (PVC) Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

• Pipe Less Than 4-inch Diameter:

- Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 80, with joints meeting requirements of 50 psi working pressure, 75 psi hydrostatic test pressure, unless otherwise shown or specified. Pipe couplings when used, shall be tested as required by ASTM D 2466.

- Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of ASTM D 1785. Schedule 80 with joints meeting the requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of ASTM D 2241, elastomeric joint, with the following applications:

SDR	Maximum Working Pressure	Minimum Hydrostatic Pressure
26	100	133
21	120	160
17	150	200
13.5	200	266

In addition to the above requirements, the pipe, couplings and fittings shall be hydrostatically tested as required by AWWA C900, and shall conform to iron pipe (I.P.S.) or cast iron outside diameter (CIOD) size dimensions.

- Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

2.2 Fittings and Specials

2.2.1 Polyvinyl Chloride (PVC) Pipe

For pipe less than 4-inch diameter, fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings, and fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467.

2.3 Joints

2.3.1 Plastic Pipe

2.3.1.1 Polyvinyl Chloride Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by IT and/or IT's representative.

2.4 Valves

2.4.1 Check Valves

Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall be of PVC Schedule 80 and have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve.

2.4.2 Ball Valves

Ball valves shall be designed for a minimum working pressure of 150 psi or as indicated. The valves shall be of PVC Schedule 80 and capable to open fully and allow easy removal and disassembly of the valve when required. The size of the valve working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve.

2.4.3 Diaphragm Valves

The diaphragm valves shall be designed for a minimum working pressure of 150 psi or as indicated. The valves shall be of PVC Schedule 80 and include a position indicator and adjustable travel stop to prevent overtightening. A name plate with valve size, working pressure, and manufacturer's name shall be cast on the body of each valve.

2.4.4 Indicator Post for Valves

Each valve shown on the drawings with the designation "P.I.V." shall be equipped with indicator post conforming to the requirements of NFPA 24. Operation shall be by a wrench which will be attached to each post.

2.5 Valve Boxes

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

2.6 Valve Pits

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown. Concrete shall have compressive strength of 3000 psi.

2.7 Miscellaneous Items

2.7.1 Meters

Meters shall be of the displacement type conforming to AWWA C700 or turbine type conforming to AWWA C701. Registers may be round or straight reading type. Connection to the groundwater recovery discharge line shall be as required for the particular installation. All meters used for the same system shall be of one type and manufacturer.

PART 3-EXECUTION

3.1 Installation

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by IT and IT's representative, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable.

3.1.2 Adjacent Facilities

3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

3.1.3 Joint Deflection

3.1.3.1 Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by IT and IT's representative, but in no case shall it exceed 5 degrees.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the water-line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines or as authorized by IT and IT's representative, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 Plastic Pipe Installation

PVC shall be installed in accordance with AWWA M23.

3.1.5 Jointing

3.1.5.1 Polyvinyl Chloride (PVC) Plastic Pipe

- Pipe less than 4-inch diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with requirements of ASTM F 477 and as required herein. All pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to the requirements of ASTM D 2467. The

179112

solvent cement used shall meet the requirements of ASTM D 2564;
the joint assembly shall be made in accordance with ASTM D 2855
and the manufacturer's specific recommendations.

SECTION 02699
VALVE PITS
AND PIPING AND EQUIPMENT IN VALVE MANHOLES
TABLE OF CONTENTS

PART 1 GENERAL	02699-1
1.1 References	02699-1
1.2 Description	02699-2
1.3 Submittals	02699-2
1.3.1 Drawings	02699-2
1.4 Delivery and Storage	02699-2
1.5 Field Measurements	02699-2
PART 2 PRODUCTS	02699-3
2.1 Standard Products	02699-3
2.2 Nameplates	02699-3
2.3 Asbestos Prohibition	02699-3
2.4 Electrical Work	02699-3
2.5 Piping and Fittings	02699-3
2.5.1 General	02699-3
2.5.2 Fittings	02699-3
2.6 Valves	02699-3
2.6.1 Packing	02699-3
2.7 Pressure Gauges	02699-4
2.8 Concrete Valve Pits and Accessories	02699-4
2.8.1 Valve Pit Construction	02699-4
2.8.2 Pipe Sleeves	02699-4
2.8.3 Pipe Supports	02699-5
2.9 Miscellaneous Metal	02699-5
PART 3 EXECUTION	02699-6
3.1 Site Work	02699-6
3.1.1 Excavation, Trenching, and Backfilling	02699-6
3.1.2 Electric Work	02699-6
3.1.3 Painting	02699-6
3.2 Piping	02699-6
3.2.1 General	02699-6
3.2.2 Pipe Supports in Valve Manholes	02699-6

Table of Contents *(Continued)*

3.3 Valve Pits and Accessories	02699-6
3.3.1 Piping and Equipment in Valve Pits	02699-6
3.4 Tests	02699-6

VALVE PITS AND PIPING AND EQUIPMENT IN VALVE MANHOLES

PART 1 GENERAL

1.1 References:

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designations only.

American National Standards Institute (ANSI)

ANSI H35.1 (1990) Alloy and Temper Designation Systems for Aluminum

American Society for Testing and Materials (ASTM)

ASTM A 53 (1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

American Society of Mechanical Engineers (ASME)

ASME B31.1 (1992) Power Piping

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

Federal Specifications (FS)

FS RR-F-621 (Rev E) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

MSS SP-25 (1978, R 1988) Standard Marking System for Valves, Fittings, Flanges, and Unions

MSS SP-58 (1988) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (1991) Pipe Hangers and Supports - Selection and Application

National Fire Protection Association (NFPA)

NFPA 70 (1990) National Electrical Code

Steel Structures Painting Council (SSPC)

SSPC Paint 16 (1991) Coal-Tar Epoxy-Polyamide Black (or Dark Red) Paint

SSPC SP 10 (1991) Near-White Blast Cleaning

1.2 Description:

This specification covers the valve pit and the valves and equipment in the valve pits shown on the drawings.

1.3 Submittals:

1.3.1 Drawings

- 1.3.1.1 Valve Pits, Pipe, and Equipment: Detail drawings for valve pits and the piping and equipment in the valve pits, such as valves and pressure gauges, including a complete list of equipment and materials, manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall show pipe anchors and guides, and layout and anchorage of equipment and appurtenances in valve pits, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.4 Delivery and Storage:

All materials and equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.5 Field Measurements:

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise IT and IT's representative of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 Standard Products:

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of IT and IT's representative, reasonably convenient to the site.

2.2 Nameplates:

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.3 Asbestos Prohibition:

Asbestos and asbestos-containing products shall not be used.

2.4 Electrical Work:

Motors, manual or automatic motor control equipment, and protective or signal devices required for the operation specified shall be provided under this section in accordance with NFPA 70.

2.5 Piping and Fittings:

2.5.1 General: Piping, fittings and piping accessories inside the valve pits shall conform to the requirements of ASME B31.1 and shall be suitable for the working pressure requirements of the system. To the greatest extent possible, the piping and fittings inside the valve pits shall match the piping and fittings located on the outside of the valve pit. All piping in valve pits shall be PVC. No supports, anchors, or stays shall be attached to any piping system in places where either the installation of or the movement of the pipe and its contents will cause damage to the construction.

2.5.2 Fittings: All fittings, valves, flanges and unions shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.6 Valves:

2.6.1 Packing: Packing used with valves shall not contain asbestos. Valve stem packing shall be die-formed, ring type specifically designated as suitable for the temperature and pressure of the service and compatible with the fluid in the

system. Packing shall be polytetrafluoroethylene with minimum 50 percent graphite filament. Valves 1-1/2 inches and smaller shall have four or five packing rings and valves 2 inches and larger shall have at least six packing rings. Spiral or continuous packing shall not be acceptable. A metal insert shall be provided having proper clearance around the valve stem at the bottom of the stuffing box and acting as a base for the packing material. Packing glands shall be furnished with a liner of noncorrosive material and shall be of one piece construction with provisions for not less than two bolts for packing adjustment.

2.7 Pressure Gauges:

Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Minimum dial size shall be 4-1/4 inches.

2.8 Concrete Valve Pits and Accessories:

2.8.1 Valve Pit Construction: Valve pit dimensions shall be as indicated. The valve pits shall be constructed of prefabricated reinforced concrete as indicated. Valve pits shall be provided with a 30 inch standard cast iron frame and removable cover as a minimum or a 36 inch by 36 inch watertight, hinged steel cover not less than 1/2-inch thick. Cast iron frames and covers shall conform to the requirements of FS RR-F-621 and shall be the type, style and weight indicated. Valve pits shall be drained as shown. Concrete sections shall not be less than 6 inches thick. The top shall be a cast concrete slab of the same strength and thickness as the valve pit. The top shall be solid hot dipped galvanized steel plate cover with 5/16 inch thick checker pattern conforming to ANSI H35.1. Valve pits shall be waterproofed. All steel components shall be protected from corrosion.

2.8.2 Pipe Sleeves: Pipe sleeves of sufficient length to pass through valve pit walls shall be provided. Pipe sleeves shall be zinc-coated steel pipe conforming to the requirement of ASTM A 53, Schedule 80 or standard weight. The pipe sleeves shall be secured in the proper position and location during construction of the valve pit. For valve pit top penetrations, the diameter of the pipe sleeve will be large enough to allow at least 1/4-inch of clearance between the pipe insulation and the sleeve, and, the sleeve will be sized to accommodate the specific mechanical seal size used for the conduit and uninsulated chilled water pipe penetration. The space between the sleeve and the pipe casing, and the caulking and sealing materials shall be selected so that there shall be NO electrical continuity between the pipe sleeve and the pipe casing when finished.

2.8.2.1 Pipe Sleeves for Conduit Penetrations: A modular mechanical type sealing assembly will be used between the valve pit pipe sleeve and the conduit casing. The mechanical seal shall consist of interlocking elastomeric links shaped to continuously fill the annular space between the casing and sleeve. The links shall be attached to each other with

corrosion resistant steel bolts, nuts and pressure plates. The link, bolts, nuts and pressure plates shall be the product of single manufacturer and shall be furnished as a package or kit. The links shall be loosely assembled with bolts to form a continuous rubber belt around the casing with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the casing and the sleeve. The pipe sleeve diameter shall be sized so that no more than one half of the seal assembly's expansion capability is used to achieve a water seal.

- 2.8.3 Pipe Supports: Pipe Supports shall be in accordance with MSS SP-58 and MSS SP-69, type as shown. All pipe supports, including structural cross support members, shall be galvanized. Chains, straps, or single point supports shall not be used.

2.9 Miscellaneous Metal:

Miscellaneous metal bolted together, shop welded, or assembled in the field, and pipe supports including structural cross support members and anchors shall be hot-dip galvanized.

PART 3 EXECUTION

3.1 Site Work:

- 3.1.1 **Excavation, Trenching, and Backfilling:** Excavation, trenching, and backfilling of the valve pits shall be as shown and in accordance with Section 02222, Excavation, Trenching, and Backfilling for Utilities Systems.
- 3.1.2 **Electric Work:** Any wiring required for the operation of the equipment specified shall be provided by others.
- 3.1.3 **Painting:** The heat affected zone of field welded galvanized surfaces and other galvanized surfaces damaged during installation shall be cleaned in compliance with SSPC SP 10 and painted. Steel and iron appurtenances, piping, and supports shall be cleaned in compliance with SSPC SP 10 and painted with SSPC Paint 16, coal-tar epoxy-polyamide.

3.2 Piping:

- 3.2.1 **General:** All piping in valve pits shall be PVC. Pipe shall be accurately cut to measurements established at the site and shall be worked into place without springing or forcing. Pipe shall clear all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation will not be permitted. Installation shall permit free expansion and contraction without damage to joints or hangers. Piping shall be installed in accordance with ASME B31.1. Joints for piping in valve pits shall be threaded. Supports, anchors, or stays shall not be attached where either expansion or the weight of the pipe will cause damage to permanent construction.
- 3.2.2 **Pipe Supports in Valve Manholes:** Horizontal and vertical runs of pipe in valve manholes shall be securely supported.

3.3 Valve Pits and Accessories:

- 3.3.1 **Piping and Equipment in Valve Pits:** Piping and equipment in valve pits shall be installed so as to provide easy access without stepping on piping or equipment, and to provide sufficient working room. Piping and equipment in valve pits shall be installed and supported as shown on the drawings.

3.4 Tests:

Tests of piping in the valve pits will be performed as part of the testing of the direct buried conduit system. These tests shall include the piping in the valve pits and shall be in accordance with the system supplier's Approved Brochure or the contract specifications.

SECTION 11301 AIR STRIPPING SYSTEM

PART 1 GENERAL

1.1 SUMMARY

This section specifies the requirements for procurement of an air stripping system. The air stripping system shall be a complete package consisting of air stripper, centrifugal pumps, bag filters, blowers, electrical, and instrumentation as indicated on the drawings identified in Section 1.2.3. The bidder shall design, provide, shop assemble, and test the system. The package shall be skid mounted, prepiped, prewired, and pretested as specified in this section. This section specifies the requirements for the air stripper including column, sump, internals and accessories. Additional products required for the system, but not specified under this section, are specified in Section 1.2.2.

1.2 REFERENCES

1.2.1 **Applicable Standards:** The publications listed below form a part of this specification where applicable. All equipment shall comply with the codes identified including revisions to date of installation.

- A. American Society of Mechanical Engineers (ASME)
- B. American Water Works Association (AWWA)
- C. Code of Federal Regulations (CFR)
- D. Military Specifications (MS)
- E. National Electrical Manufacturers Association (NEMA)
- F. Uniform Building Code (UBC)
- G. Other Applicable Federal, State, and Municipal Codes

1.2.2 **Related Sections:** Additional specifications for components designed, supplied and shop assembled under this section are found in the following related sections.

- A. Section 11211 - Pumps: Water, Centrifugal
- B. Section 11310 - Centrifugal Blowers
- C. Section 11320 - Bag Filters

1.2.3 Related Drawings: The following drawings are enclosed for reference.

- A. 305849E1 - Process Flow Diagram and Mass Balance
- B. 305849E10 - Piping and Instrumentation Diagram, Legend, Sheet 1 of 4
- C. 305849E5 - Piping and Instrumentation Diagram, Recovery Wells and Equalization Diagram, Sheet 2 of 4
- D. 305849E6 - Piping and Instrumentation Diagram, Air Stripping Tower, Sheet 4 of 4
- E. 305849E9 - Piping and Instrumentation Diagram, Liquid and Vapor Phase Carbon Adsorbers, Sheet 4 of 4

1.2.4 Specification Sheet: A summary of the requirements for the air stripper fiberglass reinforced plastic (FRP) vessel is included in the following specification sheet. The specification sheet is attached to this section.

- A. Fiberglass Reinforced Plastic Vessel Specification, A-110

1.3 UNIT PRICES

Payment for the complete air stripping system will be lump sum as described in the Payment Schedule of the Bid Form.

1.4 DESIGN REQUIREMENTS

These specifications provide the bidder with performance requirements for the system. The bidder shall be responsible for the design of a system which meets the performance requirements identified in Section 1.4.3. The bidder shall select and size all components of the air stripper system so as to meet or exceed the removal criteria identified in Section 1.4.4. The groundwater influent chemical conditions to the air stripper are identified in Section 1.4.2.

1.4.1 General Requirements:

- A. Codes: Design, fabrication, and assembly of the system shall be in accordance with the applicable codes and standards identified in Section 1.2.1.
- B. Service: The air stripper and accessories shall be suitable for continuous service in an outdoor location.
- C. Location: Fort Worth, Texas

D. Design Life: 20 years minimum

E. Air Stripper System Dimensions:

Type	Skid Mounted
Support	Free Standing/Self Supporting
Maximum Vertical Projection	as required
Maximum Surface Coverage	10 ft X 26 ft

F. Soil Bearing Capacity: N/A, Skid mounted system to be installed on concrete pad.

G. Seismic Zone: 0

H. Wind Speed: 70 mph maximum

I. Ambient Air Temperature: 3°F minimum

1.4.2 Influent Chemical Conditions: The attached groundwater analytical results represent typical influent chemical conditions to the air stripper tower.

1.4.3 Performance Requirements:

A. Number of Units: One (1)

B. Packing Surface Area: as required

C. Groundwater Flow Rate:	
Maximum	70 gpm (100,800 gpd)
Minimum	50 gpm (72,000 gpd)

D. Groundwater Temperature: 55°F constant

E. Air/Water Ratio:	
Maximum @ Maximum Flow	as required
Minimum @ Minimum Flow	as required

F. Mist Eliminator Separation Efficiency at Maximum Flow Rate and Maximum Air/Water Ratio:	
Greater than 10 micron	99.9 percent

1.4.4 Removal Criteria:

Parameter	Influent Conc. (mg/l)	Effluent Conc. (mg/l)
Trichloroethylene (TCE)	17,400	<5
cis-1,2-Dichloroethylene (c-DCE)	400	<5
Benzene	6	<5

1.5 SUBMITTALS

1.5.1 Design Calculations: Submit eight (8) copies of the following design calculations for the air stripper system. The calculations shall be verified by a Professional Engineer, registered in the state in which the system is to be installed.

A. Air stripper design calculations or model results indicating removals of the organic compounds listed. Calculations for the tower shell, mounting and support details, and lifting lugs.

B. Design calculations for the pumps, blowers, and bag filters as specified in those sections.

1.5.2 Shop Drawings: Submit eight copies (8) of all shop drawings for approval before being issued for fabrication. The drawings shall include all structural, mechanical, and electrical and instrumentation detailed drawings prepared for fabrication. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. IT Corp and/or other subcontractors will review and approve the drawings for fabrication.

1.5.3 Equipment and Materials: Submit eight (8) copies of all selected equipment and materials data for approval before being issued for purchase. The data shall consist of a complete list of material, manufacturer's description and technical literature, catalog cuts, equipment dimensions, capacities, make and model, and materials of construction for each item. Equipment and materials shall include the air stripper internals, motors, pumps, blowers, bag filters, and instrumentation and control components.

1.5.4 Installation Instructions: Submit eight (8) copies of installation instruction procedures, sequences, and precautions, including tolerances for level, horizontal, and vertical alignment. Grouting requirements including grout spaces and materials.

1.5.5 List of Equipment: Submit eight (8) copies of a parts list including recommended spare parts and maintenance supplies with current unit prices and source of supply for each item of operable equipment. List all special tools, instruments, accessories,

and special lifting and handling devices required for periodic maintenance, repair, adjustment, and calibration.

- 1.5.6 **Field Performance Tests Report:** Submit eight (8) copies of a test report in booklet form upon completion of the testing of the complete system. The required testing is specified in Section 3.3 of this specification. The report shall include all tests performed to adjust each component and tests performed to demonstrate compliance with the specified performance criteria. Each test report shall indicate the final position of all controls.
- 1.5.7 **Operating Instructions:** Submit eight (8) complete copies of operating instructions for the air stripping system in an Operating and Maintenance (O&M) Manual. The manual shall have an index listing the contents and shall be bound in a sturdy three-ring, loose-leaf binder. The instructions shall outline the step-by-step procedures required for system startup, normal operation, short- and long-term deactivation, and shutdown. An introduction and overall equipment description, purpose, function, and simple theory of operation shall be included in the beginning of the instructions. The instructions shall include the manufacturer's name, model number, service manual, parts list, brief description, basic theory, and operating features of each piece of equipment. The instructions shall include piping and component layouts and wiring and control diagrams for the system as installed.
- 1.5.8 **Maintenance Instructions:** Submit eight (8) complete copies of maintenance instructions for the air stripping system in an Operating and Maintenance (O&M) Manual. The manual shall have an index listing the contents and shall be bound in a sturdy three-ring, loose-leaf binder. The instructions shall include a list of routine maintenance procedures, calibration procedures, cleaning products and procedures, possible breakdowns, and repair and troubleshooting guides. List type of lubricant for each item of mechanical equipment, approximate quantities needed per year, and recommended lubrication intervals. Where possible, types of lubricants shall be consolidated with equipment manufacturer's approval to minimize the number of different lubricants required for plant maintenance.

1.6 QUALIFICATIONS

- 1.6.1 **Bidder:** The bidder shall have had a minimum of two (2) years experience in the design and construction of water, wastewater, industrial wastewater, and/or industrial wastewater pretreatment plants.
- 1.6.2 **Single Source Supplier:** The bidder shall be a single source supplier with full responsibility for the furnishing of the prepackaged air stripping system. The bidder need not manufacture each component of the system, but shall coordinate the design, supply, fabrication, assembly, and testing of the entire system as specified herein.

1.6.3 Stripping Tower Fabricator: The stripping tower fabricator shall prepare the fabrication drawings under the direct supervision of a professional engineer licensed to practice structural engineering in the state in which the system is to be installed.

1.6.4 Bidder's Representative: Services of a bidder's field representative who is experienced in the installation, adjustment, and operation of the equipment furnished and who has complete knowledge of the proper operation and maintenance of the system shall be provided. The representative shall be provided for a minimum of 56 hours during the startup of the system as identified in Section 1.8.

1.7 DELIVERY, STORAGE, AND HANDLING

All parts shall be preassembled to the largest extent possible, compatible with transportation limitations and equipment protection considerations. Field assembly, if any, shall require merely bolting together of match-marked components. Equipment shall be crated and delivered to protect against damage during shipment. Flange faces shall be protected from damage. All openings shall be covered to prevent entrance of dirt, water and debris. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are in operation. Finished iron or steel surfaces shall be properly protected to prevent rust and corrosion. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and other contaminants. The equipment may require outdoor storage until installation is complete. Tanks stored outdoors shall be partially filled with water to prevent blowing in strong winds.

1.8 SEQUENCING AND SCHEDULING

The system shall be designed, assembled, shipped, installed, and tested per the schedule below.

Issue Purchase Order	Jul 7, 1993
Submit Required Submittals	Jul 21, 1993
Approval of Submittals	Jul 28, 1993
Ship System	Sep 9, 1993
Complete Installation	Dec 3, 1993
Complete Startup, Testing, Training	Dec 14, 1993

1.9 GENERAL REQUIREMENTS

- 1.9.1 Nameplates: Major equipment items shall have the equipment number, manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate secured to the item of equipment. Specific nameplate requirements for each item are identified in the equipment specifications.
- 1.9.2 Verification of Dimensions: The bidder shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 MANUFACTURER

The air stripper system shall be the standard product of Nepcco Equipment Division, ORS Environmental Equipment, Hydro Group, Groundwater Recovery Systems, or approved equal.

2.2 AIR STRIPPER

2.2.1 Type: The air stripper shall be a once-through, counter-current, forced-draft type tower filled with mass transfer packing designed for the removal of volatile organic compounds (VOCs) from groundwater.

2.2.2 Column Shell: The column shell shall be constructed from fiberglass reinforced plastic (FRP) with ultraviolet (UV) inhibitors. Resin type used shall be "Atlac 4010 polyester," or equal. An inner corrosion barrier of polyester resin reinforced with 10 mil C glass surface veil with 100 mil backup shall be included. The exterior of the column shall be coated with a 3 mil thickness of white "Gelcoat" or equal to inhibit ultraviolet degradation. The shell thickness shall be as required for structural strength.

2.2.3 Manholes: The column shall be equipped with flanged manholes as shown on the related drawings to be used for filling and emptying the column packing. One access port shall be at the top of the column for access to the mist eliminator and liquid distributor. One shall be located near the bottom of the column to provide removal of the packing and packing support. One shall provide access to the sump. Flanged access ports shall be vapor and water tight and be able to withstand all loads and internal pressures during construction, operation, and cleaning.

2.2.4 Pipe Connections: The column shall be furnished with flanged influent and effluent connections as shown on the related drawings. The influent pipe connection shall be full line diameter of the connecting pipe. The effluent pipe connection may be made with standard reducing fittings if there is adequate vertical run to avoid back-up. The effluent pipe internal connection shall be a siphon type to prevent air flow bypass.

2.2.5 Instrumentation Ports: The required ports as shown on the related drawings shall be provided for the instrumentation.

2.2.6 Mounting: The column shall be flanged at the bottom for mounting to the sump and at the top to allow for the future addition of flanged column extensions and vapor treatment ducting. Off gases from the column shall be conveyed to an air pollution control unit for treatment. The top of the tower shall be bolted on so as to provide access to tower internals from above.

- 2.2.7 **Loading:** The tower shell and appurtenances shall be structurally fabricated for the seismic zone and wind loads identified in the performance requirements, plus live and dead loads of the tower shell full of water. The column shall be designed to be free standing without the support of any wires.
- 2.2.8 **Lifting Lugs:** Towers and other major components shall be provided with lifting lugs as necessary for easy handling with a crane or similiar device during installation, maintenance and replacement of tower internals.
- 2.2.9 **Assembly:** The air stripper shall be built to be delivered to the job site requiring no additional fabrication, cutting, casting, or similar work other than "bolt on" assemblies and minor electrical connections necessary for operation. The system shall be factory pre-assembled into reasonably sized modules for easy field assembly and mounted on a skid. The skid shall have a welded steel frame with steel plate or fiberglass reinforced plastic (FRP) grating with ultraviolet (UV) inhibitors decking.
- 2.2.10 **Sump:** The bottom of the column shall have a clear well. It shall be sized to provide a two (2) minute residence time when the stripper is operating at the specified capacity. A sump inspection port and drain port with manually operated valve shall be provided at the bottom of the sump to completely drain the column. Additional nozzle requirements and access required by the cleaning package (section 2.2.11) shall be provided. For ease of operation, installation, maintenance and shipping, the sump shall be flanged for mating with the column.
- 2.2.11 **Cleaning:** The air stripper shall be furnished with a cleaning package which can be operated periodically to remove mineral deposits and/or biological growth which may foul the column packing and adversely affect the unit's performance. The package shall include a corrosion resistant chemical feed pump, chemical addition port, and plumbing accessories to allow the recirculation of cleaning solutions from the sump through the column. The system shall include chemical feed tanks, pumps, pipes, and valves as necessary to allow column flushing with chemical cleaners, biocides or disinfectants.
- 2.2.12 **Packing:** The tower shall be filled with high efficiency open packing, either structured "arranged" or random "dumped" media. The packing material shall be a high performance media that offers high mass transfer efficiency at low pressure loss. The packing material of construction shall be compatible with the groundwater characteristics.
- 2.2.13 **Packing Support Plate:** A packing support plate shall be provided and shall be compatible with the packing furnished. The support plate shall be designed and supported to minimize deformation and prevent reductions in packing efficiency. The maximum design load shall include an allowance for plugged packing and a flooded column. If the bed depth exceeds the maximum vertical depth of packing recommended by the manufacturer, an intermediate support plate shall

be installed. The support plate shall also provide uniform distribution of the inlet air.

- 2.2.14 Distributor: Water shall be uniformly distributed across the packing material through a clog-free type, 120 degrees full cone spray nozzle. The pressure drop across the nozzle shall be 10 psi nominal. The spray nozzle material of construction shall be compatible with the groundwater characteristics. The nozzle shall be designed for easy removal and replacement. The nozzle shall be placed at the correct distance from the top of the packing so that it distributes the spray uniformly over the top of the packing. Liquid redistribution systems shall be recommended by the manufacturer. Distance between the re-distributors shall be as recommended by the packing manufacturer.
- 2.2.15 Mist Eliminator: A moisture separation system shall be provided to remove water droplets in the exhaust air stream. The mist eliminator shall provide better than 99.9 percent removal of 10 micron and larger water droplets at a pressure drop of less than 0.25-inches of water allowing higher throughput at lower energy usage. The unit material of construction shall be compatible with the groundwater characteristics.

2.4 ACCESSORIES

- 2.4.1 Insulation for Freeze Protection: Insulation shall be provided for freeze protection of all exposed piping. The system shall be insulated and jacketed to prevent freezing under the most severe conditions stated in the performance requirements.
- 2.4.2 Centrifugal Pumps: Two (2) Feed Pumps (P-101/P-102) and two (2) Discharge Pumps (P-111/P-112) shall be provided as specified in Section 11211.
- 2.4.3 Blowers: Two (2) Blowers (B-113/B-114) shall be provided as specified in Section 11310.
- 2.4.4 Bag Filters: Two (2) Bag Filters (F-103/F-104) shall be provided as specified in Section 11320.
- 2.4.5 Electrical Equipment and Wiring: Electrical motor driven equipment shall be provided complete with motor control centers, panels and motor starters as necessary. Motor starters shall be provided complete with properly sized thermal overload protection in each phase and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor when operating at proper electrical system voltage and frequency. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices not identified on the referenced related drawings, shall be provided under this section of the specifications.

- 2.4.6 **Power and Control Panel:** The bidder shall be responsible for the fabrication of a single power and control panel for the system. The panel shall be located near the air stripper. The bidder shall furnish conduit, power, and control wiring to the system components from the panel. Interlocks from other system components as shown on the related drawings will be field installed in the panel.
- 2.4.7 **Instrumentation and Controls:** The air stripper system shall be furnished with the instrumentation and controls specified on the related drawings.
- 2.4.8 **Special Tools:** One set of special tools, calibration devices, and instruments required for the operation, calibration, and maintenance of each type of equipment furnished shall be provided.
- 2.4.9 **Spare Parts:** Spare parts shall be provided for each different item of material and equipment specified including all of the parts recommended by the manufacturer to be replaced after one (1) year of service.
- 2.4.10 **Framed Instructions:** Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared, framed as specified above, and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting.
- 2.4.11 **Tank Signage:** A tank number, assigned by the Contracting Officer, and warning label shall be painted on the exterior of the air stripper. The size and color of the signage shall be in accordance with standards specified by the Contracting Officer. The standards will be issued with the approved shop drawings according to the schedule identified in Section 1.8.

PART 3 EXECUTION

3.1 FABRICATION

- 3.1.1 **Shop Assembly:** The entire air stripping system shall be skid mounted, prepiped, preducted and prewired. The system shall be shop assembled to the largest extent possible, compatible with transportation limitations and equipment protection considerations. No additional field fabrication, cutting, casting, or similar work other than "bolt on" assemblies and electrical connections necessary for operation shall be required.
- 3.1.2 **Number of Anchors:** The bidder shall provide anchors and fasteners capable of developing a retaining force commensurate with the strength of the item to be mounted at full design load and well suited for use with supporting construction. An

adequate number of anchors designed to prevent overturning of the tower when empty shall be installed. If anchor bolts are used, the nominal diameter shall be not less than one inch, plus a corrosion allowance of at least 1/4-inch diameter. If anchor straps are used, they shall be pre-tensioned before welding to the shell.

3.1.3 Anchor Bolts: Bolts shall have a right angle bend, hook, or plate washer. Anchor straps shall only have a plate welded to the bottom. The anchors shall be inserted into the skid to resist the computed uplift. All anchors, fasteners, and hardware to be cast in concrete shall be stainless steel.

3.1.4 Anchor Attachment: Attachment of anchors to the shell shall not add localized stresses in excess of the material tolerance. The method of attachment shall consider the effects of deflection and rotation of the shell. Anchors shall not be attached to the shell bottom. Attachment of the anchor bolts to the shell shall be through stiffened chair-type assemblies or anchor rings of adequate size and height.

3.2 PAINTING/CORROSION PROTECTION

3.2.1 Exterior Surfaces: A paint system shall be applied to all exposed metal exterior surfaces to prevent corrosion. All surfaces shall be prepared, primed and coated in accordance with the paint manufacturer's recommendations. Factory primed surfaces shall be solvent cleaned before painting.

3.2.2 Touch-up Painting: Factory painted items shall be touched up as needed. These items shall be cleaned of all foreign material and shall be primed and topcoated with the manufacturer's standard factory finish.

3.2.3 Corrosion Resistant Metals: Painting of corrosion resistant materials such as copper, brass, bronze, copper-nickel, and stainless steel is not required.

3.3 TESTING

3.3.1 Factory Tests: Each component shall be hydrostatically tested by completely filling the column and system with water and inspecting for leaks. Any leaks shall be repaired and the column retested. Equipment shall be checked for leaks after it has been filled for at least one hour. Each component shall also be dynamically tested by operating at the maximum flow specified in the performance requirements for at least one hour to assure mechanical integrity. If the test indicates that adjustments are necessary to ensure conformance to the manufacturer's standards, such adjustments shall be made prior to shipment.

3.3.2 Field Performance Tests: After the system is installed, it will be field tested and inspected under operating conditions during the startup by IT Corp. A field representative shall be present during the startup. The system must be demonstrated to run without operator intervention for 72 continuous hours. If the test shows

defects, such defects shall be corrected by the bidder and the test and inspection will be repeated by IT Corp. During the performance test, daily grab samples of the water feed to the air stripper and treated water in the sump will be collected and analyzed. The volatile organic compound composition of each sample via chemical analysis will be determined. The percentage removal of each component and the overall percentage of total volatile organics removed will be calculated.

- 3.3.3 Performance Requirements: Removals shall meet or exceed those specified in the performance requirements of this specification. If the results of the organic analyses of the influent and effluent water from the system indicate that it is not in compliance with the requirements, flow through the system will be stopped. Also, if during the performance tests the system does not meet the hydraulic, instrumentation, or control requirements, the system will be stopped. If the system fails the tests, the bidder shall determine the cause, take corrective action and IT Corp repeat the performance test until the system successfully meets the performance requirement. Repairs or modifications shall be made entirely at the bidder's expense.

3.4 FIELD SERVICES

- 3.4.1 Installation: Prior to startup, the system shall be inspected for alignment and connections by a representative of the bidder. The representative shall inspect the final installation and supervise the adjustment and testing of the equipment. The representative shall be provided at the end of installation of the system as identified in Section 1.8.
- 3.4.2 Startup: After completion of all testing, the representative shall assist IT Corp and the plant operators in plant startup. Adjustments within the control range shall be made to obtain optimum performance under actual field conditions. The representative shall be provided during the entire startup of the system as identified in Section 1.8.
- 3.4.3 Testing: The representative shall demonstrate that the system meets the performance requirements. Performance testing requirements are identified in Section 3.3 of this specification. The representative shall be provided during the testing of the system as identified in Section 1.8.
- 3.4.4 Field Training: The bidder shall assist IT Corp in a training course of operating staff as designated by the Contracting Officer. The training period shall start after the system is functionally complete but prior to final acceptance tests. The field instructions shall cover the topics included in the Operating and Maintenance Manual. The representative shall be provided during the entire training period as identified in Section 1.8.

3.5 STANDARD MECHANICAL WARRANTY

Bidder shall guarantee fabrication, workmanship, and material to be as necessary to assure properly designed and/or functioning equipment and that in the event of any defects in workmanship or material that appear within 12 months after the production startup of the equipment, but not to exceed 18 months from date of delivery, the bidder shall replace or repair at no cost to the purchaser.

Fiberglass Reinforced Plastic Vessel Specification 179135

PROJECT: AF4 - Window Area
PROJECT NO.: 305849
EQUIPMENT NO.: A-110
SPEC. BY DAK DATE 5/17/93 REV 1

QUOTATION ✓ PURCHASE _____
TOTAL NO. REQ'D: 1
SUPPLIER: _____
P.O. NO.: N/A
PRICE EACH: \$ *

PROCESS

1. Service: Air Stripper
2. Temperature °F: Operating 55 Design 55
3. pH: 7.5
4. Pressure in. w.c.: Operating Atmos Design Atmos
5. Vessel Weight Lbs: Empty * Filled with Water *

9. Horizontal _____ Vertical ✓
10. Indoor _____ Outdoor ✓
11. Design Code ASTM 3229 Other _____
12. Seismic Zone 0 Wind Load 70 mph
13. Thickness (inches): Shell * Heads *
14. Internal Finish Derakane 411, or equal

DESIGN

6. Capacity: Gallon * Baffles N/A
7. Vessel: Diameter (ft) * St. Side (ft) *
8. Head Type:

Top:

Flat _____ Flanged ✓ (column)

Dished _____ Other _____

Bottom:

Flat ✓ (sump) Flanged ✓ (column)

Dished _____ Other _____

15. External Finish Gel Coat with UV Inhibitor or equal
16. Jacketed No Jacket Type N/A Jacket Vol (gal) _____
17. Jacket Pressure psig: Operating N/A Design N/A
18. Insulation: Required Yes Thickness *
19. Stiffening/Insulation Support Rings *
20. Quantity: Hold Down Lugs * Lift Lugs *

* Supplier to select and furnish information.
N/A - Not Applicable

SECTION 11211
PUMPS: WATER, CENTRIFUGAL

PART 1 GENERAL

1.1 SUMMARY

This section specifies the requirements for procurement of horizontal centrifugal water pumps and electric motors. The bidder shall provide two (2) feed pumps and two (2) discharge pumps for an air stripper as specified on the attached specification sheets. The pumps are to be shop assembled as part of a complete skid mounted air stripping system.

1.2 REFERENCES

1.2.1 **Applicable Standards:** The publications listed below form a part of this specification where applicable. All equipment shall comply with the applicable codes identified including revisions to date of installation.

- A. American Society for Testing and Materials (ASTM)
- B. American Society of Mechanical Engineers (ASME)
- C. American Water Works Association (AWWA)
- D. Hydraulic Institute (HI)
- E. Military Specifications (MS)
- F. National Electrical Manufacturers Association (NEMA)
- G. Underwriters Laboratory (UL)
- H. Other Applicable Federal, State, and Municipal Codes

1.2.2 **Related Sections:** The pumps are to be provided as a part of a complete Air Stripping System specified in Section 11301.

1.2.3 **Specification Sheets:** A summary of the requirements for the pumps and motors is included in the following specification sheets. The specification sheets are attached to this section.

- A. Horizontal/Vertical Centrifugal Pump Specification, P-101/P-102

B. NEMA Frame Induction Motor Specification, P-101/P-102

C. Horizontal/Vertical Centrifugal Pump Specification, P-111/P-112

D. NEMA Frame Induction Motor Specification, P-111/P-112

1.3 UNIT PRICES

Payment for the pumps shall be a part of the lump sum for the complete air stripping system.

1.4 DESIGN REQUIREMENTS

1.4.1 Performance Requirements: The pumps shall be designed as a part of a complete air stripping system. The referenced Air Stripping System Specifications (Section 11301) provide the bidder with performance requirements for the complete system. The bidder shall be responsible for the selection of pumps which meet the performance requirements of the system.

1.4.2 General Requirements:

A. Codes: Design, fabrication, and assembly of the pumps shall be in accordance with the applicable codes and standards identified in Section 1.2.1.

B. Service: The pumps shall be suitable for continuous service at design conditions in an outdoor location.

C. Location: Fort Worth, Texas

D. Design Life: 20 years minimum

1.4.3 Selection Criteria: Pumps having impeller diameters larger than 90 percent of the published maximum diameter of the casing or less than 15 percent larger than the published minimum diameter of the casing will be rejected.

1.5 SUBMITTALS

1.5.1 Design Calculations: Submit eight (8) copies of the pump design calculations indicating flow rate, net positive suction head required, static pressure head, pressure drop through each component of the system, and HP requirements. The calculations shall be verified by a Professional Engineer registered in the state in which the system is to be installed.

- 1.5.2 Equipment and Materials: Submit eight (8) copies of the pump data for approval before being issued for purchase. The data shall include the selected pump make and model, capacity, dimensions, materials of construction, manufacturer's descriptive data and technical literature, performance charts and curves and catalog cuts.
- 1.5.3 List of Equipment: Submit eight (8) copies of a parts list including recommended spare parts and maintenance supplies with current unit prices and source of supply for the pumps. Also include installation instructions and the operation and maintenance procedures for the pumps.

1.6 QUALIFICATIONS

- 1.6.1 Manufacturer: The pumps shall be the standard product of a manufacturer regularly engaged in and with a successful history of the manufacture of pumps and shall be essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

1.7 GENERAL REQUIREMENTS

- 1.7.1 Nameplates: Pumps and motors shall have a standard nameplate securely affixed in a conspicuous place showing the equipment number, manufacturer's name, address, type or style, model, serial number, and catalog number. In addition, the nameplate for each pump shall show the capacity in gpm at rated speed in rpm and head in feet of water. Nameplate for each electric motor shall show at least the minimum information required. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.
- 1.7.2 Verification of Dimensions: The bidder shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 MANUFACTURER

The horizontal centrifugal pumps shall be the standard products of The Duriron Company, Ingersol-Rand, or approved equal. The motors shall be the standard products of General Electric, or approved equal.

2.2 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for tests. Where two or more pieces of equipment performing the same function are required, they shall be duplicate products of the same manufacturer.

2.3 CENTRIFUGAL PUMPS

- 2.3.1 **Pump Casings:** Pump casings shall be cast iron. The casings shall be designed to permit replacement of wearing parts. Pump casings shall be of uniform quality and free from blowholes, porosity, hard spots, shrinkage defects, cracks and other injurious defects. Defects in casings shall not be repaired except when such work is approved and is done by or under the supervision of the pump manufacturer, and then only when the defects are small and do not adversely affect the strength or use of the casing. The direction of shaft rotation shall be conspicuously indicated. The casing shall have tapped openings for air venting, priming, draining, and suction and discharge gauges. A brass or bronze umbrella or vent cock shall be furnished for venting except where automatic air vents are indicated. Drain openings in the volute, intake, or other passages capable of retaining trapped water shall be located in the low point of such passages.
- 2.3.2 **Impellers:** Impellers shall be of enclosed design and shall be constructed of cast iron, carefully finished with smooth water passageways, and shall be statically and dynamically balanced. Impellers shall be securely keyed to the pump shaft.
- 2.3.3 **Wearing Rings:** Wearing rings of bronze shall be provided for impellers. Wearing rings of a different composition or of a suitable ferrous material shall be provided for pump casings. Casing rings shall be securely fixed in position to prevent rotation. Rings shall be renewable and designed to ensure ease of maintenance.
- 2.3.4 **Shaft:** Shaft shall be of high grade steel, accurately machined, and shall be of sufficient size and strength to perform the work required. Bronze renewable shaft sleeves shall be provided for protection of the shaft in contact with water, and in the stuffing boxes. Shaft sleeves shall be keyed to the pump shaft.
- 2.3.5 **Packing Seals:** Packing shall be non-asbestos. Pump shall be shipped to the site without the packing inserted and shall be packed onsite in the presence of the pump or packing manufacturer's representative. At no time during startup or run-in shall the gland drip less water than 80 drops per minute. After not less than 40 operating hours and upon permission of the Contracting Officer, leakage rate may be reduced to 50 drops per minute or to the rate recommended by packing manufacturer.

- 2.3.6 Gland: Gland shall be split-bronze type with AISI 18-8 stainless steel eyebolts and pins or studs. Hex-nuts shall be bronze or nongalling stainless steel.
- 2.3.7 Stuffing Boxes: Stuffing boxes exposed to below atmospheric pressure at any operating condition, including starting, shall be provided with a water seal. Water seal shall consist of nonferrous lantern ring or a seal cage and required connections to the pump case.
- 2.3.8 Mechanical Seals: Mechanical seals shall be constructed in a manner and of materials particularly suitable for the temperature service range and quality of water being pumped. Seal pressure rating shall be suitable for maximum system hydraulic conditions. Mechanical seals shall not be subjected to hydrostatic test pressures in excess of the manufacturer's recommendations.
- 2.3.9 Couplings: Couplings shall be of the heavy-duty flexible type, keyed and locked to the shaft. Flexible couplings shall not be used to compensate for misalignment of pump.
- 2.3.10 Balance: All rotating parts of the equipment shall operate throughout the required range without excessive end thrust, vibration, or noise. Defects of this type that cannot be eliminated by installation adjustments will be sufficient cause for rejection of the equipment.
- 2.3.11 Bearings: Bearings shall be ball or roller type, and the main bearings shall take all radial and end thrust. Pumps that depend only on hydraulic balance to overcome end thrust will not be acceptable.
- 2.3.12 Lubrication: Bearings on horizontal-shaft pumps shall be either oil-bath type or grease type. Each oil reservoir shall be liberal in size and provided with an opening for filling, an overflow opening at the proper location to prevent overfilling, an oil-level sight glass, and a drain at the lowest point. Pumps with oil-lubrication systems shall be designed so that all shaft bearings will be isolated from the pumped liquid. An automatic sight feed oiler shall be provided on a suitable mounting bracket with connection to the shaft tube. Grease type bearings shall be provided with fittings for a grease gun and, if the bearings are not easily accessible, with grease tubing extending to convenient locations. The grease fittings shall be of a type that prevent over lubrication and the buildup of pressure injurious to the bearings.
- 2.3.13 Base Plates: Horizontal-shaft centrifugal pumps shall be provided with a common base for mounting each pump and driving unit of the pump on the same base. Each base shall be constructed of cast iron with a raised lip tapped for drainage, or of welded steel shapes with suitable drainage pan. Horizontal-shaft end suction pumps shall be mounted on a factory furnished channel steel frame. The drainage

structure shall collect the packing box leakage and shall have a 1/2-inch NPT connection to connect it to a drain.

- 2.3.14 Cocks, Plugs, and Accessories: The pumps shall be equipped with air cocks, drain plugs, and single gauges indicating discharge pressures for all pumps and suction pressures for pumps without suction lift. Gauges, equipped with a shutoff cock and snubber, and shall be calibrated in pounds per square inch and feet of water in not more than 2 psi or 5-foot increments. Gauge ranges shall be appropriate for the particular installation. Normal operating suction and discharge pressures of the pump shall be indicated on the mid-point range of the gauges. Pressure relief valve shall be furnished and installed where indicated. Suction lift pipe shall be provided with a foot valve as shown, capable of preventing loss of prime when the pump rotation is stopped.
- 2.3.15 Piping Connections: The pump suction and discharge shall be provided with flanged connections of suitable size and suitably arranged for piping shown. Piping shall be installed to preclude the formation of air pockets.
- 2.3.16 Finish: Pump shall have painted or enameled finish as is standard with the manufacturer.

2.4 ELECTRICAL EQUIPMENT

- 2.4.1 General: Electrical motor driven equipment herein specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as indicated.
- 2.4.2 Electric Motors: Motors shall be rated 230/460 volts, three phase, 60 Hz and such rating shall be stamped on the nameplate.
- 2.4.3 Control Equipment: Manually controlled pumps shall have START-STOP pushbutton in cover. Automatically controlled pumps shall have three-position "MANUAL-OFF-AUTOMATIC" selector switch in cover. Additional controls or protective devices shall be as indicated.

2.5 EQUIPMENT APPURTENANCES

- 2.5.1 Attachments: All necessary bolts, nuts, washers, bolt sleeves, and other types of attachments for the installation of the equipment shall be furnished with the equipment.
- 2.5.2 Equipment Guards: Equipment driven by open shafts, belts, chains, or gears shall be provided with all-metal guards enclosing the drive mechanism. Guard shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal

set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

- 2.5.3 Tools: A complete set of all special tools which may be necessary for the adjustment, operation, maintenance, and disassembly of all equipment shall be furnished. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment. Special tools shall be high-grade, smooth, forged, alloy, tool steel. All tools shall be delivered at the same time as the equipment to which they pertain. The Bidder shall properly store and safeguard such tools until completion of the work, at which time they shall be delivered to the Contracting Officer.

PART 3 EXECUTION

3.1 PAINTING/CORROSION PROTECTION

- 3.1.1 Factory Painting: A paint system shall be applied to all exposed metal surfaces to prevent corrosion. All surfaces shall be prepared, primed and coated in accordance with the paint manufacturer's recommendations. Factory primed surfaces shall be solvent cleaned before painting.
- 3.1.2 Corrosion Resistant Metals: Painting of corrosion resistant materials such as copper, brass, bronze, copper-nickel, and stainless steel is not required.

3.2 TESTING

- 3.2.1 Equipment Test: After installation of the pumping units and appurtenances is complete, operating tests shall be carried out to assure that the pumping installation operates properly. Each pumping unit shall be given a running test for a minimum of 2 hours. Each pumping unit shall be operated at its rated capacity. The Bidder shall provide an accurate and acceptable method of measuring the discharge flow. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

3.3 FIELD SERVICES

- 3.3.1 Installation: Prior to startup, the system shall be inspected for alignment and connections by the Bidder. The Bidder shall inspect the final installation and supervise the adjustment and testing of the equipment. Each pump shall be installed in accordance with the written instructions of the manufacturer.

3.4 STANDARD MECHANICAL WARRANTY

Bidder shall guarantee fabrication, workmanship, and material to be as necessary to assure properly designed and/or functioning equipment and that in the event of any defects in workmanship or material that appear within 12 months after the production startup of the equipment, but not to exceed 18 months from date of delivery, the bidder shall replace or repair at no cost to the purchaser.

Horizontal/Vertical Centrifugal Pump Specification

PROJECT: AF4 - Window Area
 PROJECT NO.: 305849
 EQUIPMENT NO.: P-101/P-102
 SPEC. BY DAK DATE 5/17/93 REV 1

QUOTATION _____ PURCHASE ✓
 TOTAL NO. REQ'D: 2
 SUPPLIER: _____
 P.O. NO.: N/A
 PRICE EACH: _____

GENERAL

1. Type: ANSI - Horizontal
 2. Duty: Continuous ✓ Intermittent _____
 3. Manufacturer: *
 4. Model: *
 5. Rotating @ Drive End: CW ✓ CCW _____

PROCESS

6. Service: Feed Pumps
 7. Liquid: Groundwater
 8. Design Flow (GPM): Normal 50 Max 70
 9. Pumping Temperature: °F 55
 10. SP.GR.@ Pump Temp: 1.0
 11. Viscosity @ Pump Temp: CP 1.0
 12. Vapor Press @ Pump Test: Ft. Liq. 0.4
 13. Corrosive Material (pH): 7.5
 14. Solids (Max Diameter): N/A

HYDRAULIC**FT. LIQ.**

15. Suction Press Abv Liq (ABS)(+)	<u>34</u>
16. Static Suction: Lift (-) Head (+)	<u>0</u>
17. Suction Friction Head (-)	<u>-2</u>
18. Total Suction Head (15+16+17)	<u>32</u>
19. Static Discharge Head	<u>35</u>
20. Discharge Friction Head	<u>98</u>
21. Discharge Press Abv Liq (ABS)	<u>34</u>
22. Total Discharge Head (19+20+21)	<u>167</u>
23. TDH (22-18) *	Design TDH <u>*</u>
24. NPSH Available (18-12)	<u>31</u>
25. NPSH Required	<u>*</u>
26. BHP @ Service Conditions:	<u>*</u>
27. BHP @ Max Flow for Impeller:	<u>*</u>

MATERIALS

28. Casing: Ductile Cast Iron
 29. Impeller: Ductile Cast Iron
 30. Shaft: Carbon Steel
 31. Shaft Sleeve: *
 32. Casing Gasket: *
 33. Impeller Gasket: *
 34. Baseplate: Carbon Steel

CONSTRUCTION

35. Size: Suction * Discharge *
 36. Conn Type: ANSI Flanged ✓ Other _____
 150 lb ✓ 300 lb _____
 37. Packing Type: *
 38. Lantern Ring: * Material *
 39. Bearing: *
 40. Lubrication: Oil ✓ Grease _____
 41. Impeller: Type * Size * Max *
 42. Vent Conn (Y/N) No Drain Type *
 43. Flushing Connection : (Y/N) Yes (Plugged)
 44. Mechanical Seal: Single * Double *
 Model *

DRIVER

45. Furnish w/Pump ✓ By Others _____
 46. Type: Electrical
 47. Coupling Type: _____

Comments: 1) IMPELLER DIAMETER SHALL NOT EXCEED 90 PERCENT OF MAX IMPELLER DIAMETER;
2) VENDOR TO SPECIFY THE MINIMUM FLOW REQUIREMENTS FOR THE PUMP, IF ANY;
3) FOR COMPLETE DRIVER SPECIFICATION, REFER TO "NEMA FRAME INDUCTION MOTOR SPECIFICATION SHEET"

* SUPPLIER TO SELECT AND FURNISH INFORMATION.

** REVISION

N/A - Not Applicable

NEMA Frame Induction Motor Specification

PROJECT: AF4 - Window Area
 PROJECT NO.: 305849
 EQUIPMENT NO.: P-101/P-102
 SPEC. BY DAK DATE 5/17/93 REV 1

QUOTATION _____ PURCHASE ✓
 TOTAL NO. REQ'D: 2
 SUPPLIER: _____
 P.O. NO.: N/A
 PRICE EACH: (included in pump cost)

Rated voltage	<u>230/460</u>	VOLTS
Numbers of phases	<u>3</u>	PHASE
Frequency	<u>60</u>	HZ
Full load RPM	<u>3500</u>	RPM
Horsepower	<u>*</u>	HP
Service factor	<u>1.15</u>	SF
Enclosure	<u>TEFC</u>	
Area Classification	<u>Non-Explosive Proof</u>	
Temperature identification number	<u>*</u>	
Thermal protection	<u>*</u>	
Insulation class	<u>*</u>	
NEMA frame size	<u>*</u>	
Maximum ambient temperature	<u>*</u>	°C
NEMA design letter	<u>*</u>	
NEMA code letter	<u>*</u>	
Sound pressure at three feet	<u>*</u>	dBA
Bearing type	<u>Lubricated Ball Bearings</u>	
Coupling Guard	<u>OSHA Approved</u>	
Internal switches	<u>No</u>	
Locked rotor current	<u>*</u>	AMPS
Full load current	<u>*</u>	AMPS
Full load torque	<u>*</u>	LB/FT
Power factor:		
a. Full load	<u>*</u>	%
b. 3/4 load	<u>*</u>	%
c. 1/2 load	<u>*</u>	%
Efficiency:		
a. Nominal full load	<u>*</u>	%
b. Minimum full load	<u>*</u>	%
c. 3/4 load	<u>*</u>	%
d. 1/2 load	<u>*</u>	%
Manufacturer	<u>*</u>	
Model number	<u>*</u>	
Unit price	<u>*</u>	
Delivery	<u>*</u>	

Comments: 1) MOTOR SHALL BE NONOVERLOADING AT THE END OF PUMP CURVE.
2) 1800 RPM PREFERRED.
3) MOTOR SHALL BE RATED FOR MILL AND CHEMICAL DUTY.

* SUPPLIER TO SELECT AND FURNISH INFORMATION
 ** REVISION
 N/A - Not Applicable

Horizontal/Vertical Centrifugal Pump Specification

179146

PROJECT: AF4 - Window Area
PROJECT NO.: 305849
EQUIPMENT NO.: P-111/P-112
SPEC. BY DAK DATE 5/17/93 REV 1

QUOTATION _____ PURCHASE ✓
TOTAL NO. REQ'D: 2
SUPPLIER: _____
P.O. NO.: N/A
PRICE EACH: _____

GENERAL

1. Type: ANSI - Horizontal
2. Duty: Continuous ✓ Intermittent _____
3. Manufacturer: *
4. Model: *
5. Rotating @ Drive End: CW ✓ CCW _____

PROCESS

6. Service: Discharge Pumps
7. Liquid: Groundwater
8. Design Flow (GPM): Normal 50 Max 70
9. Pumping Temperature: °F 55
10. SP.GR. @ Pump Temp: 1.0
11. Viscosity @ Pump Temp: CP 1.0
12. Vapor Press @ Pump Test: Ft. Liq. 0.4
13. Corrosive Material (pH): 7.5
14. Solids (Max Diameter): N/A

HYDRAULIC

	<u>FT. LIQ.</u>
15. Suction Press Abv Liq (ABS)(+)	<u>34</u>
16. Static Suction: Lift (-) Head (+)	<u>0</u>
17. Suction Friction Head (-)	<u>-2</u>
18. Total Suction Head (15+16+17)	<u>32</u>
19. Static Discharge Head	<u>10</u>
20. Discharge Friction Head	<u>58</u>
21. Discharge Press Abv Liq (ABS)	<u>34</u>
22. Total Discharge Head (19+20+21)	<u>102</u>
23. TDH (22-18) * Design TDH	<u>*</u>
24. NPSH Available (18-12)	<u>31</u>
25. NPSH Required	<u>*</u>
26. BHP @ Service Conditions:	<u>*</u>
27. BHP @ Max Flow for Impeller:	<u>*</u>

MATERIALS

28. Casing: Ductile Cast Iron
29. Impeller: Ductile Cast Iron
30. Shaft: Carbon Steel
31. Shaft Sleeve: *
32. Casing Gasket: *
33. Impeller Gasket: *
34. Baseplate: Carbon Steel

CONSTRUCTION

35. Size: Suction * Discharge *
36. Conn Type: ANSI Flanged ✓ Other _____
150 lb ✓ 300 lb _____
37. Packing Type: *
38. Lantern Ring: * Material *
39. Bearing: *
40. Lubrication: Oil ✓ Grease _____
41. Impeller: Type * Size * Max *
42. Vent Conn (Y/N) No Drain Type *
43. Flushing Connection : (Y/N) Yes (Plugged)
44. Mechanical Seal: Single * Double *
Model *

DRIVER

45. Furnish w/Pump ✓ By Others _____
46. Type: Electrical
47. Coupling Type: _____

Comments: 1) IMPELLER DIAMETER SHALL NOT EXCEED 90 PERCENT OF MAX IMPELLER DIAMETER;
2) VENDOR TO SPECIFY THE MINIMUM FLOW REQUIREMENTS FOR THE PUMP, IF ANY;
3) FOR COMPLETE DRIVER SPECIFICATION, REFER TO "NEMA FRAME INDUCTION MOTOR SPECIFICATION SHEET"

* SUPPLIER TO SELECT AND FURNISH INFORMATION.

** REVISION

N/A - Not Applicable

NEMA Frame Induction Motor Specification

179147

PROJECT: AF4 - Window Area
 PROJECT NO.: 305849
 EQUIPMENT NO.: P-111/P-112
 SPEC. BY DAK DATE 5/17/93 REV 1

QUOTATION _____ PURCHASE ✓
 TOTAL NO. REQ'D: 2
 SUPPLIER: _____
 P.O. NO.: N/A
 PRICE EACH: (included in pump price)

Rated voltage	<u>230/460</u>	VOLTS
Numbers of phases	<u>3</u>	PHASE
Frequency	<u>60</u>	HZ
Full load RPM	<u>1750</u>	RPM
Horsepower	<u>*</u>	HP
Service factor	<u>1.15</u>	SF
Enclosure	<u>TEFC</u>	
Area Classification	<u>Non-Explosive Proof</u>	
Temperature identification number	<u>*</u>	
Thermal protection	<u>*</u>	
Insulation class	<u>*</u>	
NEMA frame size	<u>*</u>	
Maximum ambient temperature	<u>*</u>	°C
NEMA design letter	<u>*</u>	
NEMA code letter	<u>*</u>	
Sound pressure at three feet	<u>*</u>	dB
Bearing type	<u>Lubricated Ball Bearings</u>	
Coupling Guard	<u>OSHA Approved</u>	
Internal switches	<u>No</u>	
Locked rotor current	<u>*</u>	AMPS
Full load current	<u>*</u>	AMPS
Minimum starting torque	<u>*</u>	% FULL LOAD
Minimum breakdown torque	<u>*</u>	% FULL LOAD
Full load torque	<u>*</u>	LB/FT
Power factor:		
a. Full load	<u>*</u>	%
b. 3/4 load	<u>*</u>	%
c. 1/2 load	<u>*</u>	%
Efficiency:		
a. Nominal full load	<u>*</u>	%
b. Minimum full load	<u>*</u>	%
c. 3/4 load	<u>*</u>	%
d. 1/2 load	<u>*</u>	%
Manufacturer	<u>*</u>	
Model number	<u>*</u>	
Unit price	<u>*</u>	
Delivery	<u>*</u>	

Comments: 1) MOTOR SHALL BE NONOVERLOADING AT THE END OF PUMP CURVE.
2) 1800 RPM PREFERRED.
3) MOTOR SHALL BE RATED FOR MILL AND CHEMICAL DUTY.

* SUPPLIER TO SELECT AND FURNISH INFORMATION
 ** REVISION
 N/A - Not Applicable

SECTION 11310 CENTRIFUGAL BLOWERS

PART 1 GENERAL

1.1 SUMMARY

This section specifies the requirements for procurement of centrifugal fans and electric motors. The bidder shall provide two (2) air stripper blowers as specified on the attached specification sheets. The blowers are to be shop assembled as part of a complete skid mounted air stripping system.

1.2 REFERENCES

1.2.1 Applicable Standards: The publications listed below form a part of this specification where applicable. The publications are referred to in the text by basic designation only. All equipment shall comply with the applicable codes identified including revisions to date of installation.

- A. Air Movement and Control Association (AMCA)
- B. National Electrical Manufacturers Association (NEMA)
- C. National Electrical Code (NEC)
- D. Military Specifications (MS)
- E. Other Applicable Federal, State, and Municipal Codes

1.2.2 Related Sections: The blowers are to be provided as a part of a complete Air Stripping System specified in Sairion 11301.

- A. Section 11301 - Air Stripping Systems

1.2.3 Specification Sheets: A summary of the requirements for the blowers and motors is included in the following specification sheets. The specification sheets are attached to this section.

- A. Air Blower Specification, B-113/B-114
- B. NEMA Frame Induction Motor Specification, B-113/B-114

1.3 UNIT PRICES

Payment for the blowers shall be a part of the lump sum for the complete air stripping system.

1.4 DESIGN REQUIREMENTS

1.4.1 Performance Requirements: The blowers shall be designed as a part of a complete air stripping system. The referenced Air Stripping System specifications (Section 11301) provide the bidder with performance requirements for the complete system. The bidder shall be responsible for the selection of blowers which meet the performance requirements of the system.

1.4.2 General Requirements:

A. Codes: Design, fabrication, and assembly of the blowers shall be in accordance with the applicable codes and standards identified in Section 1.2.1.

B. Service: The blowers shall be suitable for continuous service at design conditions in an outdoor location.

C. Location: Fort Worth, Texas

D. Design Life: 20 years minimum

1.5 SUBMITTALS

1.5.1 Design Calculations: Submit eight (8) copies of the blower design calculations indicating air pressure drops through each component of the system, hydraulic loading, air volume, and air:water ratio. The calculations shall be verified by a Registered Professional Engineer registered in the state in which the system is to be installed.

1.5.2 Equipment and Materials: Submit eight (8) copies of the blower data for approval before being issued for purchase. The data shall include the selected blower make and model, capacity, dimensions, materials of construction, manufacturer's descriptive data and technical literature, fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements, and catalog cuts.

1.5.3 List of Equipment: Submit eight (8) copies of a parts list including recommended spare parts and maintenance supplies with current unit prices and source of supply for the blowers. Also include manufacturer's installation instructions and the

operation and maintenance procedures including instructions for lubrication, motor and drive replacement, spare parts list and wiring diagrams for the blowers.

1.6 QUALIFICATIONS

- 1.6.1 **Manufacturer:** The blowers shall be the standard product of a manufacturer regularly engaged in and with a successful history of the manufacture of blowers and shall be essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

1.7 GENERAL REQUIREMENTS

- 1.7.1 **Nameplates:** Fans and motors shall have a standard nameplate securely affixed in a conspicuous place showing the equipment number, manufacturer's name, address, type or style, model, serial number, and catalog number. In addition, the nameplate for each fan shall show the capacity in scfm at rated speed in rpm and pressure in inches of water. Nameplate for each electric motor shall show at least the minimum information required. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.
- 1.7.2 **Verification of Dimensions:** The bidder shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 MANUFACTURER

The centrifugal blowers shall be the standard products of The New York Blower Company, EG&G Rotron, American Fan Company, or approved equal. The motors shall use the standard products of General Electric, or approved equal.

2.2 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for tests. Where two or more pieces of equipment performing the same function are required, they shall be duplicate products of the same manufacturer.

2.3 CENTRIFUGAL BLOWERS

- 2.3.1 **Selection:** The blowers shall be centrifugal type, capable of supplying air in volumes and static pressures required to produce the specified performance. The

blowers shall operate by withdrawing ambient air. The blowers shall be a low noise type and shall be sufficiently quiet to allow their safe operation.

- 2.3.2 **Backward Inclined Wheel:** The wheel shall be steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate. A cast iron hub shall be riveted to back plate and keyed to shaft with set screws.
- 2.3.3 **Forward Curved Wheel:** The wheel shall be black enameled or galvanized steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and back plate. A steel hub shall be swaged to back plate and keyed to shaft with set screw.
- 2.3.4 **Airfoil Wheel:** The wheel shall be steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange and back plate. A cast iron hub shall be riveted to back plate and keyed to shaft with set screws.
- 2.3.5 **Radial Wheel:** The wheel shall be steel construction with inlet flange, heavy reinforced back plate, plate blades with reinforcing gussets and wearing strips welded or riveted to back plate and flange. A cast iron hub shall be riveted to back plate and keyed to shaft with set screws.
- 2.3.6 **Housing:** Blower housing shall be welded steel construction and shall be statically and dynamically balanced. The housing shall be heavy gage steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
- 2.3.7 **Finish:** Exterior surfaces of the blower housing shall be finished with a protective coating as required. It shall be factory finished before assembly with enamel or prime coat. For fans handling air downstream of humidifiers, provide two additional coats of paint or fabricate of galvanized steel. Prime coating on aluminum parts is not required.
- 2.3.8 **Bearings:** The bearings shall be able to be replaced, inspected, or lubricated without disconnecting any piping or disassembling the blower. There shall be provided a positive grease seal at each bearing, designed to prevent lubricant from leaking into the air stream. Further provisions shall be made to vent the impeller side of the grease seal to atmosphere to eliminate any possible carryover of lubricant into the air stream. The drive-end bearings shall be grease lubricated and shall be provided with a grease fitting and a drain plug. The bearings shall be pillow block type, self-aligning, grease-lubricated roller bearings.

- 2.3.9 Shafts: The shafts shall be hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil, and shaft guard.
- 2.3.10 V-Belt Drive: Each blower shall be furnished with a V-belt drive with standard drive guard, and a fabricated steel base of sufficient size and rigidity to support and maintain alignment of the blower, motor, and V-belt drive. The drive shall be cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp (11.2 Kw) and under, selected so required rpm is obtained with sheaves set at mid-position shall be provided. Fixed sheave for 20 hp (15 Kw) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor shall be provided.
- 2.3.11 Belt Guard: Blowers shall be provided with all-metal guards enclosing the drive mechanism. Guard shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set on a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations. The guards shall be secured to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.4 ACCESSORIES

- 2.4.1 Fixed Inlet Vanes: An adjustable inlet blast gate shall be provided to vary air flow. It shall be steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.
- 2.4.2 Adjustable Inlet Vanes: Vanes shall be steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism out of air stream terminating in single control lever with control shaft for double width fans and locking quadrant.
- 2.4.3 Discharge Dampers: Dampers shall be parallel or opposed blade heavy duty steel damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.
- 2.4.4 Inlet/Outlet Screens: Each blower shall be furnished with an inlet air screen. The screen shall be galvanized steel welded grid.
- 2.4.5 Access Doors: An access door shall be shaped to conform to scroll, with quick opening latches and gaskets.

- 2.4.6 Scroll Drain: A scroll drain shall be 1/2 inch (13 mm) steel pipe coupling welded to low point of fan scroll.
- 2.4.7 Flexible Connectors: The manufacturer shall provide a flexible connector on the blower discharge.
- 2.4.8 Anchors and Fasteners: Manufacturer shall provide anchors and fasteners capable of developing a retaining force commensurate with the strength of the item to be mounted at full design load, and well suited for use with supporting construction. All anchors, fasteners, and hardware to be cast in concrete shall be stainless steel.
- 2.4.9 Extra Materials: Provide two (2) sets of belts for each fan.

2.5 ELECTRICAL EQUIPMENT

- 2.5.1 General: Electrical motor driven equipment herein specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as indicated.
- 2.5.2 Electric Motors: Motors shall be rated 230/460 volts, three phase, 60 Hz and such rating shall be stamped on the nameplate.
- 2.5.3 Control Equipment: Manually controlled blowers shall have START-STOP pushbutton in cover. Automatically controlled blowers shall have three-position "MANUAL-OFF-AUTOMATIC" selector switch in cover. Additional controls or protective devices shall be as indicated.

2.6 EQUIPMENT APPURTENANCES

- 2.6.1 Attachments: All necessary bolts, nuts, washers, bolt sleeves, and other types of attachments for the installation of the equipment shall be furnished with the equipment.
- 2.6.2 Equipment Guards: Equipment driven by open shafts, belts, chains, or gears shall be provided with all-metal guards enclosing the drive mechanism. Guard shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.
- 2.6.3 Tools: A complete set of all special tools which may be necessary for the adjustment, operation, maintenance, and disassembly of all equipment shall be furnished. Special tools are considered to be those tools which because of their

limited use are not normally available, but which are necessary for the particular equipment. Special tools shall be high-grade, smooth, forged, alloy, tool steel. All tools shall be delivered at the same time as the equipment to which they pertain. The Bidder shall properly store and safeguard such tools until completion of the work, at which time they shall be delivered to the Contracting Officer.

PART 3 EXECUTION

3.1 PAINTING/CORROSION PROTECTION

- 3.1.1 **Factory Painting:** A paint system shall be applied to all exposed metal surfaces to prevent corrosion. All surfaces shall be prepared, primed and coated in accordance with the paint manufacturer's recommendations. Factory primed surfaces shall be solvent cleaned before painting.
- 3.1.2 **Corrosion Resistant Metals:** Painting of corrosion resistant materials such as copper, brass, bronze, copper-nickel, and stainless steel is not required.

3.2 TESTING

- 3.2.1 **Equipment Test:** After installation of the blowers and appurtenances is complete, operating tests shall be carried out to assure that the blower installation operates properly. Each unit shall be given a running test for a minimum of 2 hours. Each unit shall be operated at its rated capacity. The Bidder shall provide an accurate and acceptable method of measuring the discharge flow. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.
- 3.2.2 **Environmental Requirements:** Do not operate the fans for any purpose until the ductwork is clean, filters are in place, bearings are lubricated, and the fan has been test run under observation.

3.3 FIELD SERVICES

- 3.3.1 **Installation:** Prior to startup, the system shall be inspected for alignment and connections by the Bidder. The Bidder shall inspect the final installation and supervise the adjustment and testing of the equipment. Each blower shall be installed in accordance with the written instructions of the manufacturer.

3.4 STANDARD MECHANICAL WARRANTY

Bidder shall guarantee fabrication, workmanship, and material to be as necessary to assure properly designed and/or functioning equipment and that in the event of any defects in workmanship or material that appear within 12 months after the production startup of the equipment, but not to exceed 18 months from date of delivery, the bidder shall replace or repair at no cost to the purchaser.

Air Blower Specification

179156

PROJECT: AF4 - Window Area
PROJECT NO.: 305849
EQUIPMENT NO.: B-113/B-114
SPEC. BY DAK DATE 5/17/93 REV 1

PURCHASE ✓
TOTAL NO. REQ'D: 2
SUPPLIER: _____
P.O. NO.: _____
PRICE EACH: \$ • (includes motor)

GENERAL

1. Type: Low Noise Pressure Blower
2. Duty: Continuous ✓ Intermittent _____
3. Manufacturer: •
4. Model: •
5. Rotating @ Drive End: CW ✓ CCW _____

PROCESS

6. Required Capacity (SCFM): •
7. Inlet Volume at blower inlet (ACFM): •
8. Inlet Temperature: Outdoor Ambient
9. Temperature Rise: °F •
10. Relative Humidity (%): Outdoor Ambient
11. Barometer (PSIA): 14.7
12. Inlet Pressure (PSIA): 14.7
13. Discharge Pressure at Blower Outlet (psig): 0.5
14. Pressure Relief Valve: N/A

ACCESSORIES

15. Inlet Silencer: Yes
16. Outlet Silencer: No
17. Inlet Screen: Yes
18. Check Valve: As shown on related drawings
19. Pressure Gauge: As shown on related drawings
20. Shut-Off Valves: Butterfly
21. Flexible Connectors: Flanged inlet and outlet
22. Magnehelic on Suction & Discharge Side: As shown on related drawings

MATERIALS

23. Housing: Carbon Steel
24. Wheel: Carbon Steel
25. Shaft: Carbon Steel
26. Baseplate: One piece steel with mounting holes and vibration isolation pads

CONSTRUCTION

27. Size: Suction •
Discharge •
28. Conn Type: ANSI Flanged ✓ Other _____
150 lb _____
300 lb _____

DRIVER

29. Furnish w/Blower ✓
By Others _____
30. Type: Electrical
31. Drive: Direct: _____ V-Belt: ✓
32. Coupling Type: N/A

Comments: 1) FOR COMPLETE DRIVER SPECIFICATION, REFER TO "NEMA FRAME INDUCTION MOTOR SPECIFICATION SHEET"
2) WHEEL DIAMETER SHALL NOT EXCEED 90 PERCENT OF MAX WHEEL DIAMETER

• SUPPLIER TO SELECT AND FURNISH INFORMATION.
N/A Not applicable

NEMA Frame Induction Motor Specification

PROJECT: AE4 - Window Area
 PROJECT NO.: 305849
 EQUIPMENT NO.: B-113/B-114
 SPEC. BY DAK DATE 5/17/93 REV 0

QUOTATION ☒ PURCHASE _____
 TOTAL NO. REQ'D: 2
 SUPPLIER: _____
 P.O. NO.: _____
 PRICE EACH: \$ * (included in blower price)

Rated voltage	<u>230/460</u>	VOLTS
Numbers of phases	<u>3</u>	PHASE
Frequency	<u>60</u>	HZ
Full load RPM	<u>3600</u>	RPM
Horsepower	<u>*</u>	HP
Service factor	<u>1.15</u>	SF
Enclosure	<u>TEFC</u>	
Area Classification	<u>Nonexplosion proof</u>	
Temperature identification number	<u>*</u>	
Thermal protection	<u>Yes</u>	
Insulation class	<u>F</u>	
NEMA frame size	<u>*</u>	
Maximum ambient temperature	<u>40</u>	°C
NEMA design letter	<u>B</u>	
NEMA code letter	<u>*</u>	
Sound pressure at three feet	<u>93</u>	dBA
Bearing type	<u>Lubricated Ball Bearings</u>	
Coupling Guard	<u>OSHA Approved</u>	
Internal switches	<u>No</u>	
Locked rotor current	<u>*</u>	AMPS
Full load current	<u>*</u>	AMPS
Minimum starting torque	<u>*</u>	% FULL LOAD
Minimum breakdown torque	<u>*</u>	% FULL LOAD
Full load torque	<u>*</u>	LB/FT
Power factor:		
a. Full load	<u>*</u>	%
b. 3/4 load	<u>*</u>	%
c. 1/2 load	<u>*</u>	%
Efficiency:		
a. Nominal full load	<u>*</u>	%
b. Minimum full load	<u>*</u>	%
c. 3/4 load	<u>*</u>	%
d. 1/2 load	<u>*</u>	%
Manufacturer	<u>*</u>	
Model number	<u>*</u>	
Unit price	<u>*</u>	
Delivery	<u>*</u>	

Comments: 1) MOTOR SHALL BE NONOVERLOADING AT THE END OF FAN CURVE
2) MAXIMUM MOTOR RPM SHALL BE 1800
3) MOTOR SHALL BE MILL AND CHEMICAL DUTY

* SUPPLIER TO SELECT AND FURNISH INFORMATION

** REVISION

N/A Not applicable

SECTION 11320 BAG FILTERS

PART 1 GENERAL

1.1 SUMMARY

This section specifies the requirements for procurement of bag filters. The bidder shall provide two (2) multiple-basket bag filters of the types specified in this section. The filters are to be shop assembled as part of a complete skid mounted air stripping system.

1.2 REFERENCES

1.2.1 Applicable Standards: The publications listed below form a part of this specification where applicable. All equipment shall comply with the applicable codes identified including revisions to date of installation.

- A. American Society for Testing and Materials (ASTM)
- B. American Society of Mechanical Engineers (ASME)
- C. American Water Works Association (AWWA)
- D. Military Specifications (MS)
- E. Other Applicable Federal, State, and Municipal Codes

1.2.2 Related Sections: The filters are to be provided as a part of a complete Air Stripping System specified in Section 11301.

1.3 UNIT PRICES

Payment for the filters shall be a part of the lump sum for the complete air stripping system.

1.4 DESIGN REQUIREMENTS

1.4.1 Performance Requirements: The filters shall be designed as a part of a complete air stripping system. The referenced Air Stripping System specified in (Section 11301) provides the bidder with performance requirements for the complete system. The bidder shall be responsible for the selection of filters which meet the performance requirements of the system.

1.4.2 General Requirements:

- A. Codes: Design, fabrication, and assembly of the filters shall be in accordance with the applicable codes and standards identified in section 1.2.1.
- B. Service: The filters shall be suitable for continuous service at design conditions in an outdoor location.
- C. Location: Fort Worth, Texas
- D. Design Life: 20 years minimum

1.5 SUBMITTALS

- 1.5.1 Design Calculations: Submit eight (8) copies of the filter design calculations indicating the filtering efficiency, solids loading and filter capacity. The calculations shall be verified by a Registered Professional Engineer registered in the state in which the system is to be installed.
- 1.5.2 Equipment and Materials: Submit eight (8) copies of the filter data for approval before being issued for purchase. The data shall include the selected filter make and model, capacity, dimensions, materials of construction, manufacturer's descriptive data and technical literature, and catalog cuts.
- 1.5.3 List of Equipment: Submit eight (8) copies of a parts list including recommended spare parts and maintenance supplies with current unit prices and source of supply for the filters. Also include installation instructions and the operation and maintenance procedures for the filters.

1.6 QUALIFICATIONS

- 1.6.1 Manufacturer: The filters shall be the standard product of a manufacturer regularly engaged in and with a successful history of the manufacture of filters and shall be essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

1.7 GENERAL REQUIREMENTS

- 1.7.1 Nameplates: Filters shall have a standard nameplate securely affixed in a conspicuous place showing the equipment number, manufacturer's name, address, type or style, model, serial number, and catalog number. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

- 1.7.2 Verification of Dimensions: The bidder shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 MANUFACTURER

The multiple-basket bag filters shall be the standard products of Plenty Products, Rosedale Products, Filtrations Systems, or approved equal.

2.2 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified, and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for tests. Where two or more pieces of equipment performing the same function are required, they shall be duplicate products of the same manufacturer.

2.3 FILTERS

- 2.3.1 Selection: The unit shall be a duplex filter system designed to handle a flow of 50 gpm of groundwater with added filter area for heavy dirt loads. The filters shall be rated at a maximum pressure of 150 psig at 100 degrees F ASME Code. The bag filters shall be of adequate pore size to protect the air stripper packing media from clogging. The bag filters shall be of sufficient capacity to prevent frequent changing.
- 2.3.2 Type: The bag filters shall be designed for the filtration of a wide range of products. The units shall have a positive seal basket and compression assembly which allows for quick efficient bag replacement and reduces operating and maintenance costs.
- 2.3.3 Filter Vessel: The body and cover of the vessel shall be constructed of 304 stainless steel. All wetted surfaces shall be epoxy coated. The filter shall have a nominal diameter of 24-inches. The filter baskets shall be No. 2 size, shall be 1/8" perforated on 3/16" centers, and constructed of 304 stainless steel.
- 2.3.4 Filter Bags: There shall be six (6) filter bags per vessel with a surface area of 4.4 square feet per bag. The bags shall be No. 2 size, 20 micron polyester.
- 2.3.5 Connections: The filter shall be furnished with standard 2-inch flanged inlet and outlet connections. The system shall be a duplex arrangement with 2-inch flanged three-way ball valves and a single lever operating handle. The system shall be

equipped with a differential pressure gauge to monitor the pressure drop across the system. The system shall be factory assembled and ready for installation.

- 2.3.6 Assembly: The duplex unit shall be preassembled and shall require no additional fabrication or similar work other than external pipe connections.
- 2.3.7 Cleaning: The bags shall be removed and replaced with new bags when the differential pressure gauge indicates a set pressure reading. The full bags shall be disposed of off-site.

2.4 EQUIPMENT APPURTENANCES

- 2.4.1 Attachments: All necessary bolts, nuts, washers, bolt sleeves, and other types of attachments for the installation of the equipment shall be furnished with the equipment.
- 2.4.2 Tools: A complete set of all special tools which may be necessary for the adjustment, operation, maintenance, and disassembly of all equipment shall be furnished. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment. Special tools shall be high-grade, smooth, forged, alloy, tool steel. The Bidder shall properly store and safeguard such tools until completion of the work, at which time they shall be delivered to the Contracting Officer.

PART 3 EXECUTION

3.1 FABRICATION

- 3.1.1 Factory Painting: A paint system shall be applied to all exposed metal surfaces to prevent corrosion. All surfaces shall be prepared, primed and coated in accordance with the paint manufacturer's recommendations. Factory primed surfaces shall be solvent cleaned before painting.
- 3.1.2 Corrosion Resistant Metals: Painting of corrosion resistant materials such as copper, brass, bronze, copper-nickel, and stainless steel is not required.

3.2 TESTING

- 3.2.1 Factory Tests: Each unit shall be tested by the manufacturer. The units shall be hydrostatically tested by completely filling with water and inspecting for leaks. Any leaks shall be repaired and the unit retested. The unit shall be checked for leaks after it has been filled for at least one hour. The preassembled piping of the unit shall be air tested at an air pressure of 25 psig. Any detection of air leaks shall be repaired and the unit retested.

3.2.2 Equipment Test: After installation of the units is complete, operating tests shall be carried out to assure that the installation operates properly. Each unit shall be given a running test for a minimum of 2 hours. Each unit shall be operated at its rated capacity. Tests shall assure that the units have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

3.3 FIELD SERVICES

3.3.1 Installation: Prior to startup, the system shall be inspected for alignment and connections by the Bidder. The Bidder shall inspect the final installation and supervise the adjustment and testing of the equipment. Each unit shall be installed in accordance with the written instructions of the manufacturer.

3.4 STANDARD MECHANICAL WARRANTY

Bidder shall guarantee fabrication, workmanship, and material to be as necessary to assure properly designed and/or functioning equipment and that in the event of any defects in workmanship or material that appear within 12 months after the production startup of the equipment, but not to exceed 18 months from date of delivery, the bidder shall replace or repair at no cost to the purchaser.

SECTION 11330 LIQUID PHASE CARBON ADSORPTION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

This section specifies the requirements for procurement of a liquid phase carbon adsorption system. The adsorption system shall be a predesigned package consisting of two vessels, vessel internals, interconnecting piping and valves, and initial charge of virgin granular activated carbon. The bidder shall select, fabricate, and test the system. The system shall be designed to allow series or parallel operation for efficient carbon usage and ease of carbon exchange. The package shall be skid mounted, prepiped, and pretested as specified in this section.

1.2 REFERENCES

1.2.1 Applicable Standards: The publications listed below form a part of this specification where applicable. All equipment shall comply with the codes identified including revisions to date of installation.

- A. American Society of Mechanical Engineers (ASME)
- B. American Water Works Association (AWWA)
- C. Code of Federal Regulations (CFR)
- D. Military Specifications (MS)
- E. National Electrical Manufacturers Association (NEMA)
- F. Uniform Building Code (UBC)
- G. Other Applicable Federal, State, and Municipal Codes

1.2.2 Related Drawing: The following drawing is enclosed for reference.

- A. 305849E9 -Piping and Instrumentation Diagram, Liquid and Vapor Phase Carbon Adsorbers.

- 1.2.3 Specification Sheet: A summary of the requirements for the carbon steel adsorber vessels is included in the following specification sheet. The specification sheet is attached to this section.

A. Liquid Phase Carbon Adsorption System, Vessel Specification, C-131/C-132

1.3 UNIT PRICES

Payment for the complete system will be lump sum as described in the Payment Schedule of the Bid Form.

1.4 DESIGN REQUIREMENTS

- 1.4.1 Performance Requirements: These specifications provide the bidder with performance requirements for the system. The bidder shall be responsible for the selection of a system which meets the stated performance requirements. The bidder shall size all components of the adsorption system so as to meet or exceed the removal criteria identified in the attached Table 1. The influent parameters and contaminant concentrations for the groundwater stream is also presented in Table 1.

1.4.2 General Requirements:

A. Codes: Design, fabrication, and assembly of the system shall be in accordance with the applicable codes and standards identified in Section 1.2.1.

B. Service: The adsorbers and accessories shall be suitable for continuous service in an outdoor location.

C. Location: Fort Worth, Texas.

D. Design Life: 20 years minimum.

E. Adsorber System Dimensions:

Type:	Skid Mounted/Pressure Vessels
Maximum Vertical Projection:	as required
Maximum Surface Coverage:	8 feet x 26 feet

F. Soil Bearing Capacity: N/A, skid mounted system to be installed on concrete pad.

G. Seismic Zone: 0

H. Wind Speed: 70 mph maximum.

I. Number of Units: Two (2).

J. Groundwater Flow Rate:

Maximum: 70 gpm (100,800 gpd)

Operating: 50 gpm (72,000 gpd)

K. Groundwater Temperature: 55°F constant.

1.5 SUBMITTALS

1.5.1 Design Calculations: Submit eight (8) copies of the adsorption system design calculations indicating hydraulic loading, empty bed detention time, carbon loading, and carbon change out period. The calculations shall be verified by a Professional Engineer registered in the state in which the system is to be installed.

1.5.2 Operation and Maintenance Manual: Submit eight (8) copies of an operation and maintenance manual which shall include the following:

A. System flow diagram, arrangement, and foundation drawings;

B. Equipment specifications and spare parts;

C. Procedures for startup, process flow, adsorber staging, backwash, and carbon transfer operations; and

D. Troubleshooting and maintenance guides.

1.5.3 Testing Results: Submit eight (8) copies of all test results upon completion of the testing of the complete system. The required testing is specified in Section 3.2 of this specification. The results shall include all factory static and dynamic tests and field tests performed to demonstrate compliance with the specified performance criteria.

1.6 QUALIFICATIONS

1.6.1 Bidder: The bidder shall have had a minimum of two (2) years experience in the construction of water, wastewater, industrial wastewater, and/or industrial wastewater pretreatment plants. The bidder shall be a single source supplier with full responsibility for the furnishing of the carbon adsorption system.

Equipment shall be supported by a service organization that is reasonably convenient to the job site and acceptable to the Contracting Officer.

1.6.2 Vessel Fabricator: The steel pressure vessel fabricator shall prepare the fabrication drawings under the direct supervision of a professional engineer licensed to practice structural engineering in the state in which the system is to be installed.

1.6.3 Manufacturer's Representative: Services of a manufacturer's field representative who is experienced in the installation, adjustment, and operation of the equipment furnished and who has complete knowledge of the proper operation and maintenance of the system shall be provided. The representative shall be provided for a minimum of 56 hours during the startup of the system as identified in Section 1.8.

1.7 DELIVERY, STORAGE, AND HANDLING

All parts shall be preassembled to the largest extent possible, compatible with transportation limitations and equipment protection considerations. Field assembly, if any, shall require merely bolting together of match-marked components. Equipment shall be crated and delivered to protect against damage during shipment. Flange faces shall be protected from damage. All openings shall be covered to prevent entrance of dirt, water and debris. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are in operation. Finished iron or steel surfaces shall be properly protected to prevent rust and corrosion. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and other contaminants. The equipment may require outdoor storage until installation is complete. Tanks stored outdoors shall be partially filled with water to prevent blowing in strong winds.

1.8 SEQUENCING AND SCHEDULING

The system shall be designed, assembled, shipped, installed, and tested per the schedule below:

Issue Purchase Order	July 7, 1993
Submit Required Submittals	July 21, 1993
Approval of Submittals	July 28, 1993
Ship System	September 9, 1993
Complete Installation	December 3, 1993
Complete Startup, Testing, Training	December 14, 1993

1.9 SUBMITTALS

- 1.9.1 Nameplates: Each carbon adsorption vessel shall have the equipment number, manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate secured to the item of equipment.
- 1.9.2 Verification of Dimensions: The bidder shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 MANUFACTURER

The carbon adsorption system shall be the standard product of Tigg Corp, Calgon Corp, Encotech, or approved equal.

2.2 PROCESS DESCRIPTION

- 2.2.1 Adsorption Process: The adsorption process utilizes granular activated carbon (GAC) for efficient removal of dissolved organic compounds from water requiring treatment. Adsorption is a physical process in which the dissolved compounds adhere to the surface of the carbon particle. The large surface area contained within the internal structure of the granular carbon particle provides a substantial capacity for the organic compounds to be removed. The adsorption system shall provide exposure of contaminated water to a quantity of granular activated carbon.
- 2.2.2 Normal Operation: The adsorption system shall consist of two process vessels which can be operated in series or parallel. Water shall be conveyed to the adsorption system from a source providing sufficient pressure. Water shall enter the lead vessel at the top and flow downward through the carbon bed. An internal underdrain system shall be provided to collect the treated water. The treated water shall then be conveyed to the top of the second vessel. The treated water shall flow downward through the second bed of granular activated carbon and be discharged from the system through effluent piping.
- 2.2.3 Contact Time: The system design shall provide sufficient total contact time of the contaminated water with the carbon for the removal of the specified contaminants to the required levels. The contact time shall be calculated on a "superficial" or "empty bed contact time" basis.
- 2.2.4 Carbon Changeout: When the lead vessel becomes saturated with contaminants adsorbed from the water, the vessel shall be taken out of service to replace the

spent carbon with fresh carbon. The entire flow shall be diverted to the second stage vessel allowing the treatment process to remain in service. The lead vessel shall be pressurized to 15-30 psig with utility water and the spent carbon displaced into a receiving container. Fresh carbon shall then be transferred as a slurry from a delivery container into the empty vessel utilizing pressure or an eductor system.

- 2.2.5 Vessel Rotation: After the vessel had been recharged, the system valving shall be changed so that the fresh carbon bed is placed in the second stage to continue series operation. On each subsequent carbon bed replacement, the vessel receiving fresh carbon shall be placed in the polish position.

2.3 EQUIPMENT DESCRIPTION

- 2.3.1 Adsorber Vessels: The adsorbers shall be vertical cylindrical pressure vessels with flanged and dished ASME Code top and bottom heads. The vessel shall be designed, constructed, and stamped in accordance with the ASME Code, Section VIII for a design pressure rating of 75 psig at 150°F.
- 2.3.2 Nozzles: The adsorber shall be equipped with a manway located approximately 4 foot from grade to allow for maintenance access. The adsorber shall also be provided with a quick opening cover located on the top shell for ease of dry media fill. The top, bottom, and side nozzles shall be 150 lb flanges. The top center nozzle shall be equipped with a full cone spray nozzle to wash the vessel sides during transfer operations. Additional nozzles and piping shall be provided as described on the attached vessel specification sheet.
- 2.3.3 Underdrain Collection System: The underdrain collection system shall be at or near the bottom of the carbon bed to collect treated water. The system shall be constructed of the Schedule 80 solid PVC pipe with all joints to be solvent cemented. The collector shall be designed for maximum adsorbent utilization, retain the granular activated carbon, allow water flow with a minimum of pressure drop, and be installed in a threaded pipe tap for ease of replacement. Carbon steel shall not be in direct contact with the carbon.
- 2.3.4 Process and Utility Piping: Process and utility piping shall include all pressure gauges, sample ports, and valving to operate the adsorbers in series, parallel, and independent modes. The piping shall be capable of creating a "lead-lag" operation without disconnecting any piping. The piping shall include influent water feed, treated water discharge, adsorber vent lines, utility water, carbon supply, and carbon discharge. Backwash connections shall be provided at the vent line (backwash outlet) and at the underdrain (backwash inlet).

- 2.3.5 Pipe Material: All piping shall be solid PVC plastic pipe with PVC plastic fittings rated for 150 psig at 75°F. The piping shall be PVC Schedule 80 and all connections shall be socket welded except for unions and flanges. Flanges shall be 150 lb connected to pipe with socket welding. Gaskets, as required, shall be provided as neoprene.
- 2.3.6 Valve Material: All valves shall be PVC regular port ball valves, rated for 150 psig water service at 75°F. The valves shall have PVC body, ball and stems, Teflon seals, Viton seats, snap-on T-type directional handle, and socket union ends.
- 2.3.7 Connections: The granular activated carbon fill and discharge piping shall be 2" nylon male "Kamlok" style hose connectors for hose transfer operations. Flush connections, consisting of 3/4" hose connectors and 3/4" ball valves, shall be provided between the plug valves and hose connectors.
- 2.3.8 Rupture Disk: The system vent line shall be equipped with a rupture disk for emergency pressure relief. The rupture disk shall be constructed of impervious graphite and be designed to relieve pressure at 75 psig +/- 5 percent.
- 2.3.9 Gages: The adsorption system shall be provided with pressure gages to indicate influent, effluent, intermediate, and vent pressures. Pressure gages shall be for 0-100 psig service.
- 2.3.10 Automatic Siphon Break: An automatic siphon breaker shall be provided at the effluent line of each adsorber to prevent draining of the system and maintain water level in the adsorber should influent flow stop.
- 2.3.11 Steel Skid Installation: The two adsorbers and all associated piping shall be preassembled on a steel skid for unitized shipment and installation. The steel skid shall be constructed of channel iron with holes provided in the corner gussets for installation on a flat surface. The system shall be anchored by anchor bolts, clamps, or bolts added after the system is set. Connections to the skid piping network shall be the only additional field installation required.

2.4 ACCESSORIES

- 2.4.1 Insulation for Freeze Protection: Insulation shall be provided for freeze protection of all exposed piping. The system shall be insulated and jacketed to prevent freezing under the most severe conditions stated in the referenced codes and standards.
- 2.4.2 Instrumentation: The adsorption system shall be furnished with the pressure gages and differential instrumentation identified on the related drawing.

- 2.4.3 **Special Tools:** One set of special tools, calibration devices, and instruments required for the operation, calibration, and maintenance of the equipment furnished shall be provided.
- 2.4.4 **Spare Parts:** Spare parts shall be provided for each different item of material and equipment specified including all of the parts recommended by the manufacturer to be replaced after one (1) year of service.
- 2.4.5 **Framed Instructions:** Framed instructions under glass or in laminated plastic, showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, carbon changeout procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared, framed as specified above, and posted beside the layout. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting.
- 2.4.6 **Tank Signage:** A tank number, assigned by the Contracting Officer, and warning label shall be painted on the exterior of each vessel. The size and color of the signage shall be in accordance with standards specified by the Contracting Officer. The standards shall be issued with the approved shop drawings according to the schedule identified in Section 1.8.

2.5 GRANULAR ACTIVATED CARBON DESCRIPTION

An initial charge of virgin granular activated carbon shall be provided and installed within each adsorber vessel, either before or after shipment, as required. The activated carbon shall be Calgon Carbon Filtrasorb 300, or approved equal, and shall conform to the following specification.

Test	Specification
Iodine No. - Minimum	900
Ash Wt. - Maximum	10
Abrasion No. - Minimum	75
Mesh Size Nomenclature	8 x 30
Particle Size through U.S. No. 30 Mesh - % Max.	4

PART 3 EXECUTION

3.1 PAINTING/CORROSION PROTECTION

- 3.1.1 Abrasive Blasting: The adsorber shall be constructed of carbon steel and shall have all welds and any other sharp edges ground smooth, and all imperfections such as skip welds, delaminations, scabs, slivers, and slag corrected prior to abrasive blasting. All surfaces shall be degreased prior to abrasive blasting. The adsorber internal surface shall be blasted to a white metal surface specification to provide an anchor pattern in the metal corresponding to approximately 4 mil. The exterior of the adsorber shall be sandblasted to a commercial blast cleaning specification.
- 3.1.2 Interior Surfaces: Immediately after sandblasting, the interior surface shall be lined with an abrasion resistant protective coating in two multi-pass spray coatings per the manufacture's instructions. This coating shall exhibit excellent chemical resistance to a wide range of water solutions and provide excellent abrasion resistance.
- 3.1.3 Exterior Surfaces: Following cleaning of the exterior, finish painting in two applications before rust can form. The surface shall be finished as per manufacturer's recommendations.

3.2 TESTING

- 3.2.1 Factory Tests: Each vessel shall be hydrostatically tested by completely filling with water and inspecting for leaks. Any leaks shall be repaired and the vessel retested. Piping shall be checked for leaks after it has been filled for at least one hour. The system shall also be dynamically tested by operating at the maximum flow specified in the performance requirements for at least one hour to assure mechanical integrity. If the test indicates that adjustments are necessary to ensure conformance to the manufacturer's standards, such adjustments shall be made prior to shipment.
- 3.2.2 Field Performance Tests: After the system is installed, it will be field tested and inspected under operating conditions during the startup by IT Corp. A field representative shall be present during the startup. The system must be demonstrated to run without operator intervention for 72 continuous hours. If the test shows defects, such defects shall be corrected by the bidder and the test and inspection will be repeated by IT Corp. During the performance test, daily grab samples of the water feed to the adsorbers and treated water discharge will be collected and analyzed. The volatile organic compound composition of each sample via chemical analysis will be determined. The percentage removal of each

component and the overall percentage of total volatile organics removed will be calculated.

- 3.2.3 Performance Requirements: Removals shall meet or exceed those specified in the performance requirements of this specification. If the results of the organic analyses of the influent and effluent water from the system indicate that it is not in compliance with the requirements, flow through the system will be stopped. Also, if during the performance tests the system does not meet the hydraulic or instrumentation requirements, the system will be stopped. If the system fails the tests, the bidder shall determine the cause, take corrective action and IT Corp repeat the performance test until the system successfully meets the performance requirement. Repairs or modifications shall be made entirely at the bidder's expense.

3.3 FIELD SERVICES

- 3.3.1 Installation: Prior to startup, the system shall be inspected for alignment and connections by a representative of the bidder. The representative shall inspect the final installation and supervise the adjustment and testing of the equipment. The representative shall be provided at the end of the installation of the system as identified in Section 1.8.
- 3.3.2 Startup: After completion of all testing, the representative shall assist IT Corp and the plant operators in plant startup. Adjustments within the control range shall be made to obtain optimum performance under actual field conditions. The representative shall be provided during the entire startup of the system as identified in Section 1.8.
- 3.3.3 Testing: The representative shall demonstrate that the system meets the performance requirements. Performance testing requirements are identified in Section 3.2 of this specification. The representative shall be provided during the testing of the system as identified in Section 1.8.
- 3.3.4 Field Training: The bidder shall assist IT Corp in a training course of operating staff as designated by the Contracting Officer. The training period shall start after the system is functionally complete but prior to final acceptance tests. The field instructions shall cover the topics included in the Operating and Maintenance Manual. The representative shall be provided during the training period as identified in Section 1.8.

3.4 STANDARD MECHANICAL WARRANTY

Bidder shall guarantee fabrication, workmanship, and material to be as necessary to assure properly designed and/or functioning equipment and that in the event of any

defects in workmanship or material that appear within 12 months after the production startup of the equipment, but not to exceed 18 months from date of delivery, the bidder shall replace or repair at no cost to the purchaser.

Table 1
Influent Characteristics and
Discharge Limits
Liquid Phase Carbon Adsorption System

Parameters	Influent Conc (mg/l)	Influent Loading (lb/day)	Discharge Conc (mg/l)	Discharge Loading (lb/day)
Flow Rate, Q	50 gpm	72,000 gpd	50 gpm	72,000 gpd
Trichloroethylene, TCE	< 0.005	0.00	ND	0.00
trans 1,2-Dichloroethylene, t-DCE	< 0.005	0.00	ND	0.00
cis 1,2-Dichloroethylene, c-DCE	< 0.005	0.00	ND	0.00
trans 1,2-Dichloropropene	< 0.005	0.00	ND	0.00
Benzene	< 0.005	0.00	ND	0.00
Chromium, Cr	0.10	0.06	0.10	0.06
Hexavalent Chromium, Cr+6	0.14	0.08	0.14	0.08
Zinc, Zn	0.11	0.07	0.11	0.07
Lead, Pb	<0.0050	0.00	<0.0050	0.00
Manganese, Mn	0.10	0.06	0.10	0.06
Calcium, Ca	110	66.05	110	66.05
pH	7.5		7.5	
Total Suspended Solids, TSS	0	0.00	0	0.00
Total Dissolved Solids, TDS	426	255.68	426	255.68
Temperature	55°F		55°F	
Biological Oxygen Demand, BOD	<1		<1	

Liquid Phase Carbon Adsorption System

Vessel Specification

PROJECT: AF4 - Window Area
 PROJECT NO.: 305849
 EQUIPMENT NO.: C-131/C-132
 SPEC. BY: DAK DATE: 5/17/93 REV: 0

QUOTATION: ✓ PURCHASE: _____
 TOTAL NO. REQ'D: Two (2)
 SUPPLIER: _____
 P.O. NO.: _____
 PRICE EACH: \$ *

PROCESS

1. Service: Groundwater
 2. Flow Rate: 50 gpm
 3. Empty Bed Contact Time (minimum): 11 Minutes
 4. Temperature: Operating 55°F Design 165°F
 5. Pressure: Operating 40 psig Design 50 psig
 6. Ph: 7.5
 7. Backwash rate: *gpm
 8. Backwash Valves Operation: Manual ✓ Automatic _____
 9. Carbon Transfer Mode: Off-site Transfer

DESIGN

10. Pressure Relief Set Point: 70 psig
 Device: Safety Valve _____ Rupture Disc ✓
 11. Service: Indoor _____ Outdoor ✓
 12. Design Code ASME Section VIII, Div. 1 Other: _____
 13. Vessel Stamp: Yes ✓ No _____
 14. Seismic Zone: 0 Wind Load: 70 mph
 15. X-Ray: Full _____ Spot _____ Per Code ✓ None _____
 16. Head Type:
 Top:
 ASME ✓ Flanged _____
 Dished ✓ Other _____
 Bottom:
 ASME ✓ Flanged _____
 Dished ✓ Other _____
 17. Thickness (inches): Shell * Heads *

Comments:

* SUPPLIER TO SELECT AND FURNISH INFORMATION

N/A - Not Applicable

PROCESS

18. Vessel: Diameter * St. Side *
 Overall Height: *
 19. Vessel Weight: Empty 11,400 lb
 Filled with water: 30,000 lb
 Operating: 30,000 lb
 20. Carbon Volume per Vessel: 72 cf
 21. Carbon Weight per Vessel: 2,000 lb
 22. Inlet Distributor: 2-inch
 23. Stiffener Rings: N/A
 24. Quantity: Support Rings N/A Lift Lugs 4

MATERIAL OF CONSTRUCTION

25. Material: Carbon Steel
 Liner: Vinyl Ester Thickness: 3/8-inch
 Piping Module: Schedule 80 PVC
 Valves Water Side: Butterfly, CPVC
 Valves Carbon Transfer: CPVC
 Underdrain Collection System: Schedule 80 PVC
 Insulation: Req. N/A Thickness N/A

APPENDIX B

RFQ AND SUBCONTRACTOR'S PROPOSAL

179177
FILE COPY



June 14, 1993

305895-ITONP-0001
Project No. 305895

Mr. Steve Erickson
Remsys Industries
608 Shelby Road
Everman, TX 76140

Subject: Request for Quotation
Groundwater Pumping and Treatment System
Carswell Air Force Base, Golf Course Area
Fort Worth, Texas

Dear Mr. Erickson:

You are invited to submit a fixed price proposal to provide, install, and maintain the groundwater pumping and treatment system in the golf course area at Carswell Air Force Base. The scope of this project was discussed at our site meeting on May 24 and 25, 1993 and is summarized in the attached Scope of Work. Your bid price shall be divided into the five tasks presented in the Scope of Work. All proposals must be received no later than 4:00 p.m. EST, Monday, June 21, 1993. Address your proposal and all questions concerning this solicitation to:

IT Corporation
2790 Mosside Boulevard
Monroeville, PA 15146
Attn: Victor D. Dozzi, Project Manager
Telephone: (412) 372-7701
FAX: (412) 373-7135

Sincerely,

Victor D. Dozzi, PE
Project Manager

VDD:git
Attachment

Regional Office

William Penn Plaza • 2790 Mosside Boulevard • Monroeville, Pennsylvania 15146-2792 • 412-372-7701

IT Corporation is a wholly owned subsidiary of International Technology Corporation

**SCOPE OF WORK
GROUNDWATER PUMPING AND TREATMENT SYSTEM
CARSWELL AIR FORCE BASE, GOLF COURSE AREA
FORT WORTH, TEXAS**

Task 1.0 - Collection Pipe:

- 1.1 Install the below grade groundwater collection pipe and electrical conduit as shown on the attached Groundwater Recovery System - Plan (305895E1) and Groundwater Recovery System - Details (305895E2). As shown on the drawings, the collection pipe and conduit shall connect the eight existing groundwater recovery wells to a treatment system located at the northern end of White Settlement Road. As discussed during the site meeting, the piping will also be used as part of an interim measure to connect recovery well CAR-RW2 to a rental air stripping unit (Task 2.0). The piping may also be used as part of a future expansion to connect additional recovery wells to the treatment system.
- 1.2 This task includes trench excavation, pipe bedding, installation of PVC water pipe and PVC conduits, trench back filling, and asphalt patching. The scope also includes installation of well head valve boxes with the indicated valves and meters, pipe tee valve boxes, conduit pull boxes, and clean outs as indicated on the drawings.
- 1.3 Install the below grade treated water discharge pipe as shown on the attached drawings. The discharge pipe shall connect the treatment system to the identified Fort Worth Water Dept sanitary sewer manhole as shown on the drawings.
- 1.4 Provide a lump sum bid to perform the work described in this task. A purchase order for this work will be issued approximately July 2, 1993. The collection trenching will be installed between approximately July 6 and July 19, 1993.

Task 2.0 - Rental Air Stripping Unit

- 2.1 Provide a modular air stripping treatment unit on a rental basis. The unit shall be capable of treating 30 gpm. The unit shall include a low profile air stripper, blower, sump, transfer pump, bag filter, two 500 lb steel carbon canisters, and initial charge of virgin liquid phase granular activated carbon. The unit shall be skid mounted, pre-piped, pre-wired, and pre-tested in the shop. The unit shall include a control panel and all electrical, control, and instrumentation components required to operate the unit. The skid of each unit shall provide containment for the total volume of all vessels on the skid.

SCOPE OF WORK (cont)

- 2.2 Provide and install a groundwater pumping system in existing recovery well CAR-RW2. The system shall include a stainless steel submersible well pump capable of delivering 30 gpm at 110 ft TDH (Grundfos Model 25S10-7 or equal). The pump shall be installed with 1 1/2-inch stainless steel riser pipe, well seal, and level control electrodes. A locking and weather tight control panel shall be installed near the well head. The control panel shall contain the pump motor starter, level relay, on-off-auto switch, and running indicator light. Electrical power for the pump shall be provided from the treatment unit as described in Task 2.3.
- 2.3 Install the rental air stripping unit at the northern end of White Settlement Road. The unit skid shall be securely mounted on the asphalt pavement with cinch-anchors. The influent and discharge to the treatment unit shall be connected to the collection and discharge pipe installed in Task 1.0. Electrical power for the treatment unit shall be connected from a power source as identified by Carswell AFB. Electrical power wires for the pumping system in CAR-RW2 shall be pulled through the conduit installed in Task 1.0. Control wires from the treatment unit to CAR-RW2 shall also be pulled through the existing conduit. Control shall be provided to shut down the recovery well if there is low air flow through the air stripper or if there is a high level in the air stripper sump.
- 2.4 Provide maintenance of the treatment unit and recovery well on a regular basis. The maintenance shall include visual inspection and adjustments as necessary to properly operate the system. The maintenance shall also include the collection of samples as required by the permitting agencies. Provide a cost for replacement of the liquid phase carbon based on an estimated usage rate. Do not include the analytical costs for the samples or the disposal costs for the spent carbon.
- 2.5 Provide a monthly rental fee for the air stripping unit (Task 2.1) and a monthly fee for the maintenance (Task 2.4). Provide a separate lump sum bid to install the pumping system (Task 2.2) and rental treatment unit (Task 2.3). A purchase order for this work will be issued approximately July 2, 1993. The system will be installed between approximately July 6 and July 19, 1993. The rental will continue for approximately four (4) months.

SCOPE OF WORK (cont)**Task 3.0 - Modular Air Stripping Treatment Units (30 gpm)**

- 3.1 Provide five (5) modular air stripping treatment units capable of treating 30 gpm each. Each unit shall include a two-stage low profile air stripper, blower, sump, transfer pump, bag filter, two 500 lb steel carbon canisters, and initial charge of virgin liquid phase granular activated carbon. The units shall be pre-designed, skid mounted, pre-piped, pre-wired, and pre-tested in the shop. Each unit shall include an individual control panel and all electrical, control, and instrumentation components required to operate each unit independently. The skid of each unit shall provide containment for the total volume of all vessels on the skid.
- 3.2 Provide the following submittals with your proposal:
- a Piping and Instrumentation Diagram (P&ID) for the proposed treatment unit including performance specifications for each component on the skid (air stripper, blower, sump size, transfer pump, bag filter, carbon canisters, etc.).
 - a shop drawing of the proposed treatment unit showing the skid size, the component layout on the skid, the control panel, and the containment.

The drawings shall provide sufficient detail for review by IT Corp, USACE - Tulsa, Air Force Plant No. 4, and Carswell AFB. The drawings shall also provide sufficient detail for the acquisition of operating permits from the required agencies. The drawings will be approved by IT Corp before being issued for fabrication.

- 3.3 Provide a unit bid price for each modular unit. A purchase order for the units will be issued approximately July 2, 1993. The units shall be fabricated, tested and shipped within 12 weeks from the issuance of the purchase order.

Task 4.0 - Install Pumping and Treatment Systems

- 4.1 Provide and install groundwater pumping systems in seven (7) existing recovery wells. Each system shall include a stainless steel submersible well pump capable of delivering 30 gpm at 110 ft TDH (Grundfos Model 25S10-7 or equal). The pump shall be installed with 1 1/2-inch stainless steel riser pipe, well seal, and level control electrodes. A locking and weather tight control panel shall be installed near each well head. The control panel shall contain the pump motor starter, level relay, on-off-auto switch, and running indicator light. Electrical power for each pump shall be provided from the treatment unit as described in Task 4.2.

SCOPE OF WORK (cont)

- 4.2 Install the five modular air stripping units at the northern end of White Settlement Road. Each unit skid shall be securely mounted on the asphalt pavement with cinch-anchors. The influent and discharge to each treatment unit shall be connected to the collection and discharge pipe installed in Task 1.0. Valves shall be provided to balance the flow to each unit. Electrical power for the treatment units shall be connected from the same power source identified by Carswell AFB for the rental treatment unit. Electrical power wires for each recovery well shall be pulled through the conduit installed in Task 1.0. Control wires from the treatment units to the recovery wells shall also be pulled through the existing conduit. Control shall be provided to shut down all the recovery wells if there is low air flow through any air stripper or if there is a high level in any air stripper sump.
- 4.3 Provide a lump sum bid per well to install the pumping systems (Task 4.1). Provide a separate lump sum bid to install all the treatment units (Task 4.2). A purchase order for this work will be issued approximately July 2, 1993. The systems will be installed between approximately October 7 and October 21, 1993.

Task 5.0 - System Maintenance

- 5.1 Provide maintenance of the treatment units and recovery wells on a regular basis. The maintenance shall include visual inspection and adjustments as necessary to properly operate the system. The maintenance shall also include the collection of samples as required by the permitting agencies. Provide a cost for replacement of the liquid phase carbon based on an estimated usage rate. Do not include the analytical costs for the samples or the disposal cost for the spent carbon.
- 5.2 Provide a monthly fee for the maintenance described in this task. A purchase order for this work will be issued approximately July 2, 1993. The system operation will begin approximately October 22, 1993. The maintenance will continue for approximately 24 months.

**REMSYS INDUSTRIES**

608 Shelby Road
Everman, Texas 76140

June 18, 1993

Phone (817) 293-2277
FAX (817) 568-0734

International Technology Corporation
Regional Office
William Penn Plaza
2790 Mossdale Boulevard
Monroeville, PA. 15146-2792

Attention: Mr. Victor D. Dozzi, PE

**RE: Groundwater Pumping and Treatment System
Carswell Air Force Base, Golf Course Area
Ft. Worth, Texas
REMSYS Project Number: 93.1041-1TX**

Dear Mr. Dozzi,

Remsys Industries, Inc. (**REMSYS**) is pleased to submit this proposal to provide, install, and maintain the groundwater pumping and treatment system at the subject site in accordance with directives and design considerations prepared by IT Corporation and forwarded to **REMSYS**. A groundwater pumping and treatment system is required at the site due to elevated concentrations of TCE existing within the groundwater underlying the subject site.

The groundwater pumping and treatment system equipment proposed herein is based upon IT Corporation's investigations previously conducted and conclusions derived from those investigations.

SCOPE OF SERVICES

Task 1.0 - Collection Pipe:

1.1 REMSYS will install a below grade groundwater collection pipe and electrical conduit (as shown on Plan: 305895E1 and Details: 305895E2) to connect the seven existing groundwater recovery wells to a treatment system located at the northern end of White Settlement Road. This piping will also be used as part of an interim measure to connect recovery well CAR-RW2 to a **REMSYS**' rental air stripping unit, and can be used for any future expansions to connect additional recovery wells to the treatment system.

1.2 REMSYS will provide trench excavation, pipe bedding, installation of PVC water pipe and PVC conduits, trench back filling, and asphalt patching. Installation of well head valve boxes with the indicated valves and meters, pipe tee valve boxes, conduit pull boxes, and clean outs will also be performed at this time. In order to reduce the cost of electrician services, pulling of all wires and installation of all required service boxes (Task 2.3 and Task 4.2) will be addressed concurrently.

PN 93.1041-1TX
IT Corporation
Carswell A.F.B.
June 18, 1993



1.3 REMSYS will install a below grade treated water discharge pipe which will connect the treatment system to the identified Fort Worth Water Department sanitary sewer manhole as shown on the drawings.

1.4 Schedule and Cost

REMSYS will initiate these services immediately upon receipt of IT Corporation's acceptance of this agreement. The cost for this scope of services is based upon the above referenced line items. Upon receipt of approval for this proposal, this task is anticipated to be initiated on July 6, 1993, and be completed by July 19, 1993. The total cost is as follows:

Installation (1.1-1.3)

PERSONNEL

Description	Hours	Rate	Total
Principal	70	45.00	3,150.00
Project Manager	140	40.00	5,600.00
Equipment Operator	140	30.00	4,200.00
Remedial Tech	140	25.00	3,500.00
Remedial Tech	140	25.00	3,500.00
Remedial Tech	140	25.00	3,500.00
Journeyman Electrician	247.50	25.00	6,187.50
Journeyman Electrician	247.50	25.00	<u>6,187.50</u>
Sub Total:			\$ 36,711.00

SPECIAL EQUIPMENT

Description	Hours	Rate	Total
Mobilization	1	400.00	400.00
Mileage	980	.45	441.00
Backhoe	140	1,400.00	1,400.00
Bobcat	140	1,100.00	1,100.00
Concrete Saw & Blades	2	175.00	350.00
Jackhammer	2	75.00	150.00
Compressor	8	125.00	1,000.00
Dump Truck	20	35.00	700.00
Dump Fee	1	200.00	200.00
Water Tank	4	50.00	200.00
Compactors	14	150.00	2,100.00
Security Fence	10 units	75.00	750.00
T Posts	170	4.00	680.00
Water Pump	4	50.00	<u>200.00</u>
Sub Total:			\$ 9,671.00



179184

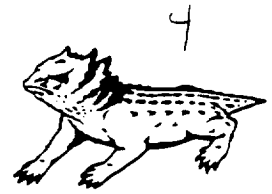
MATERIALS

Quantity	Description	Rate	Total
2,700'	Schedule 80 3" PVC Pipe with Bell Ends	1.26 / ft.	3,402.00
2,700'	Schedule 40 2" PVC Electric Conduit	.44 / ft.	1,188.00
35	Schedule 40 2" PVC Electric Conduit 90's	2.76	96.60
20	Schedule 40 2" PVC Electric Conduit Tee	4.30	86.00
15	Schedule 80 3" PVC 90's	5.58	83.70
15	Schedule 80 3" PVC Tee	10.29	154.35
10	Schedule 80 3" PVC Coupling	7.35	73.50
28	Schedule 80 1" PVC True Union Ball Valve	16.22	454.16
7	Schedule 80 1" PVC True Union Diaphragm Valve	82.32	576.24
7	1" Brass Master Meter with Totalizer Flow Meter	108.67	760.69
7	Schedule 80 1" PVC True Union Check Valve	18.51	129.57
35	Schedule 80 1" PVC Tee	2.21	77.35
14	Schedule 80 PVC 1" X 1/2" Reducer	.99	13.86
7	Schedule 80 1/2" PVC True Union Ball Valve	11.52	80.64
7	Schedule 80 1" PVC 90's	1.25	8.75
14	Schedule 80 1" PVC Female Adaptor	2.21	30.94
7	Schedule 80 PVC 2" X 1" Reducer	3.03	21.21
7	Schedule 80 1" PVC Union	11.94	83.58
7	Schedule 80 PVC 3" X 2" Reducer	8.33	58.31
7	Schedule 80 PVC 1" X 1/4" Reducer Slip X Thread	.99	6.93
3	Schedule 80 3" PVC Stationary Wye	58.44	175.32
3	Schedule 80 3" PVC 45	12.80	38.40
3	Schedule 80 3" PVC Female Adaptor	13.60	40.80
3	Schedule 80 3" PVC Threaded Plug	7.73	23.19
9 qts.	PVC Glue	5.88	52.92
5 qts.	PVC Purple Primer	5.88	29.40
7	Fab. Steel Well Vaults with Hinged Locking Covers 4' X 4' X 3' (Submitted as approved equal)	875.00	6,125.00
7	PVC 24" X 24" X 10" Waterproof Conduit Pull Box (Submitted as approved equal)	27.57	192.99
7	PVC 24" X 24" X 10" Waterproof Clean Out Frame (Submitted as approved equal)	27.57	192.99
28	6" OD X 5' Concrete Filled Protection Post	18.50	518.00
	Steel Reinforcement Wire and Rod	250.00	250.00
7 yds.	Concrete	70.00	490.00
275 cubic yds	Sand	6.00	1,650.00
	Grass Seed and Mulch	750.00	750.00
	Concrete Frame Lumber	500.00	<u>500.00</u>

Sub Total:

\$ 18,415.39

PN: 93.1041-1TX
IT Corporation
Carswell A.F.B.
June 18, 1993



179185

ELECTRICAL PARTS

41,000 ft. #8 THWN coated stranded copper wire
41,000 ft. # 10 THHN coated stranded copper wire
16,000 ft. # 12 THHN coated stranded copper wire
400 ft. 1" PVC electrical conduit for loops from J-boxes to wells
480 volt Cord Caps - male and female
125 volt Cord Caps - male and female
1 - 200 amp 600 volt disconnect and box
2 - 100 amp 600 volt panels and breakers
1 - Meter Socket and Meter
Junction Boxes
Metal Wire Ways
1 - Service Truck
Misc. Hand Tools

Sub Total:

\$ 15,918.00

LUMP SUM BID (Task 1.0):

\$ 80,715.39

PN 93 1041-1TX
 IT Corporation
 Carswell A.F.B.
 June 18, 1993



Task 2.0 - Rental Air Stripping Unit:

2.1 The modular rental air stripping treatment unit (pre-piped, pre-wired, pre-tested, and skid mounted with self containment) proposed herein will be delivered to the site, installed securely with cinch-anchors, and maintained by **REMSYS** personnel. The following will be utilized as rental equipment:

- **REMSYS** Model LP1-H Air Stripping System (1-40 gpm) with Blower, Sump, High / Low Pressure Switch Alarm and High / High Level Alarm.
- Transfer Pump.
- Bag Filter
- Coated Carbon Steel Skid.
- Electric Control Panel.
- Two (2) 200 lb. Liquid Phase Carbon Canisters.
- 400 lbs. Activated Carbon - Liquid Phase.

2.2 **REMSYS** will provide and install a groundwater pumping system in the existing recovery well, CAR-RW2. This system will include a Grundfos Model 25S10-7 stainless steel submersible well pump capable of delivering 30 gpm at 110 ft. TDH. The pump will be installed with 1-1/2" stainless steel riser pipe, well seal, and three (3) level control electrodes. A locking and weather tight control panel will be installed near the well head. The control panel will contain the pump motor starter, level relay, on-off-auto switch, and running indicator light. Electrical power for the pump will be provided from a single control module that was provided in Task 1.1. The manufacturers of the devices supplied by **REMSYS** to be used in the construction of the well pump control module are as follows:

- Main Control Panel
 Wiegmann
 Nema 12
 Locking Type
- Main Disconnect
 Bremis
 600 Volt, 3 Phase, 25 Amp
- Motor Starters
 Telemechanique
 IEC Style
 with Thermal Overloads
- Relays
 IDEC
 Din Rail Sockets
- Operators and Indicator Light
 22.5 mm
 Telemechanique
- Fuse Blocks & Fuses
 600 Volt Rated
 Gould Shamut

PN 93.1041-1TX
IT Corporation
Carswell A.F.B.
June 18, 1993

179187



- Control Transformer
150 VA 480 / 115
Square D
- Terminal Blocks
Telemechanique

* Substitutions may be made if original items are not available in a reasonable delivery time.

2.3 REMSYS will install the rental air stripping unit at the northern end of White Settlement Road. The rental unit skid will be securely mounted on the asphalt pavement with cinch-anchors. The influent and discharge to the treatment unit shall be connected to the collection and discharge pipe installed in Task 1.0. Electrical power for the treatment unit shall be connected from the power source supplied by Carswell AFB. Electrical power wires for the rental unit will have been installed in Task 1.0. Control wires from the treatment unit to CAR-RW2 will also have been installed through the existing conduit in Task 1.0. A master control relay will be provided to shut down all the recovery wells if a low air flow alarm through any air stripper, or a high level alarm in any air stripper sump occurs.

2.4 The Operations and Maintenance Schedule proposed herein is based upon the minimum time allowed for the continuous and successful operation of the temporary groundwater treatment facility. The following services will be performed by **REMSYS** to accomplish the required maintenance tasks during the approximate four (4) month service period of the rental unit.

- Conduct site visits on a once weekly basis.
- Perform system function testing and record operational system dynamics.
- Conduct electrical systems checks as required.
- Inspect all system components on a weekly basis for component wear, operation efficiencies, iron precipitate build-up, backflushing requirements, and other required maintenance items.
- Collect samples as required by the permitting agencies.
- Review documentation pertaining to flow rates, treated gallonage, and treatment efficiencies achieved for each months' operation.
- Submit a monthly operations and maintenance report and summary to IT Corporation with invoice.
- Replacement of spent carbon is not anticipated to be necessary.

179188



PN 93.1041-1TX
 IT Corporation
 Carswell A F B.
 June 18, 1993

2.5 Schedule and Cost

REMSYS will initiate these services immediately upon receipt of IT Corporation's acceptance of this agreement. The cost for this scope of services is based upon the above referenced line items. Upon receipt of approval for this proposal, this task is anticipated to be initiated upon completion of all requirements listed in Task 1.0. The total cost for each task is as follows:

(2.1) Monthly Rental Fee

Modular Air Stripping Treatment Unit (REMSYS Model LP1-H)	1,700.00
Activated Liquid Phase Canisters (REMSYS Model LP-CC-200)	<u>300.00</u>
LUMP SUM BID (Task 2.1):	\$ 2,000.00 / Month

Set-up / Demobilization Fees

400 lbs. Virgin Activated Liquid Phase Carbon (**est. one time charge)	1.66 / lb.	*664.00 per episode
Vacuum Removal and Drumming of Carbon (**est. one time charge)		<u>300.00</u> per episode
INITIAL LUMP SUM BID (Task 2.1):		\$ 964.00

* Spent Carbon to Remain the Property of the United States Air Force, or their designated agent.

** Anticipate initial 400 lbs. carbon should be adequate for 4 months rental period. **REMSYS** will notify IT Corporation if circumstances arise which require additional carbon.

(2.4) Monthly Maintenance Fee

Remedial System Technician (Once per week - 4 hr. minimum)	<u>625.00</u> per month
LUMP SUM BID (Task 2.4):	\$ 625.00 / month

Optional Services

Emergency On-Site Calls 40.00 / hr. + \$.30 / mile

PN 93.1041-1TX
IT Corporation
Carswell A.F.B.
June 18, 1993

179189



(2.2) Stainless Steel Submersible Well Pump

INSTALLATION

Labor Title	Rate	Hours	Total
Project Manager	40.00	3	120.00
Remedial Tech	25.00	3	75.00
Remedial Tech	25.00	3	<u>75.00</u>
Sub Total:			\$ 270.00

PARTS REQUIRED

Quantity	Item	Unit Costs	Total
40'	1-1/2" 304 Stainless Steel Pipe	9.08 /ft	363.20
3	304 Stainless Steel 1-1/2" Couplings	10.21	30.63
1	Grundfos Model (25S10-7) 3 phase Motor Well Pump	1,128.41	1,128.41
1	NEMA 4 Well Pump Control Module with Level Control Probes	702.50	<u>702.50</u>

Sub Total: \$ 2,224.74

LUMP SUM BID (Task 2.2): \$ 2,494.74

(2.3) Installation of Rental Air Stripper

INSTALLATION

Labor Title	Rate	Hours	Total
Project Manager	40.00	8	320.00
Remedial Tech	25.00	8	200.00
Remedial Tech	25.00	8	200.00
Journeyman Electrician	25.00	10	<u>250.00</u>

Sub Total: \$ 970.00

SPECIAL EQUIPMENT REQUIRED

Description	Units	Unit Cost	Total
ATV Forklift-Installation Only	1	225.00	225.00
Cinch Anchors	4	50.00	<u>200.00</u>

Sub Total: \$ 425.00

LUMP SUM BID (Task 2.3): \$ 1,395.00



Task 3.0 - Modular Air Stripping Treatment Units:

3.1 REMSYS will provide five (5) modular air stripping treatment units capable of treating at 30 gpm each. Each modular air stripping treatment unit will consist of the following:

- One (1) Low Profile, Two Stage (1-40 gpm) Air Stripper (**REMSYS** Model LP2-HF).
- One (1) Liquid Phase Carbon Canister (**REMSYS** Model CC-1000-CS).
- One (1) Ronningen-Petter Bag Filter (Model CST-224-LP).
- One (1) **REMSYS** Wastewater Treatment System Control Module.
- One (1) Grundfos EP150-5050 E Series Pump (5 hp TEFC - 480 volt - 3 phase motor).
- One (1) **REMSYS** 14' X 6' X 8" Polyurethane Acrylic Coated Carbon Steel Skid.

* Please note: No one system is dependent upon the others to perform. Any unit may be removed and it will operate independently at another site. The removal will not interfere with the operations at the original site.

3.2 Specifications on the **REMSYS** Model LP2-HF (1-40 gpm) Low Profile, Two Stage Air Stripper are as follows:

- Two (2) baffled HDPE air stripping trays (5' X 5') with a total surface area of 25 cubic feet for contaminated water treatment.
- One (1) 36" X 4" sight glass per tray.
- Locking latches for easy access.
- Steel frame construction.
- Easy to remove 1-1/4" PVC air transfer lines.
- One (1) HDPE 36" X 20" X 20" treated water transfer sump (60 gallon capacity).
- Two (2) Rotron Model 606 regenerative blowers rated at 200 CFM at 89" of water (3 hp TEFC - 480 volt - 3 phase electric motor).

3.2 Specifications on the **REMSYS** Model CC-1000-CS Liquid Phase Carbon Canister are as follows:

- 36" OD X 84" carbon steel vessel.
- 2" inlet and outlet.
- Rated for continuous operation at 50 PSI and 30 gpm.
- 15" X 12" manway.
- 3" flanged carbon removal port.



3.2 Specifications on the Ronningen-Petter Bag Filter (Model CST-224-LP) are as follows:

- 6" OD X 29" epoxy coated carbon steel.
- 2" female threaded inlet and 2" female threaded outlet.
- Pressure rated at 160 PSI.
- Hinged cover.
- 510 square inches of filtration surface area.
- Bag filters available in 3 to 150 micron range.

3.2 Specifications on the Sump Pump are as follows:

- Grundfos EP150-5050 E series pump.
- Close coupled end suction centrifugal pump.
- 2" suction inlet.
- 1-1/2" discharge outlet.
- Rated at 30 gpm at 126 feet of head.
- Brass impeller.
- Pump shaft made from AISI 416 SS.
- Shaft seal is carbon / ceramic with Buna N elastomer and stainless steel parts.
- Pump has a 5 hp TEFC - 480 volt - 3 phase motor.
- Volute, motor stool, and baseplate are made of cast iron.

3.2 Specifications on the REMSYS Groundwater Treatment System Skid are as follows:

- 14' X 6' interior skid dimensions.
- Skid base plate consists of a 14' X 6' X 1/4" square sheared carbon steel plate.
- Side and end panels are 12" carbon steel channel.
- Cross Members are made from 4" carbon steel I Beam.
- The base plate is seam welded to the 12" channel to prevent water loss.
- After assembly each skid is drilled and tapped with 5/16" bolt holes for the mounting of each item required to complete the groundwater treatment skid.



- All pipe supports are constructed of Unistrut welded to a 4" X 4" X 1/8" steel plate with a 3/8" hole drilled into each corner for bolt mounting to the skid.
- Each skid will be sandblasted and coated with polyurethane acrylic paint.

3.2 Specifications and functions on the **REMSYS** Groundwater Treatment System Control Module are as follows:

- Locking NEMA 12 steel control cabinet.
- Hand-off switches, one (1) for each blower.
- High / Low air pressure photohelic shutdown switches, one for each blower with interlock to well master control relay.
- Hand-off auto switch for sump pump.
- Warnck level control for automatic operation of sump pump.
- Warnck level control for High / High sump level which will interlock with the well pump master control relay and system feed line solenoid valve.
- Float switch for sump High / High level control which will interlock with the well pump master control relay and system feed line solenoid valve.
- Two (2) time delay start timers for High / Low pressure photohelic shutdown switches.
- Three (3) green "run" light indicators.
- One (1) red High / Low pressure shutdown indicator light.
- One (1) red sump High / High level shutdown indicator light.
- Control transformer.
- Terminal blocks.
- Motor starters, telemechanique IEC style with thermal overloads.
- 600 volt fuse blocks and fuses.

***Please note: Each wastewater treatment module will come from the factory prewired, preplumbed, and insulated. Each module will be tested at the factory prior to delivery.**

3.2 Diagrams and Flow Chart shipped separately in Fedex Tube.

PN 93 1041-1TX
IT Corporation
Carswell A.F.B.
June 18, 1993

179193



3.3 Schedule and Cost

REMSYS will initiate these services immediately upon receipt of IT Corporation's acceptance of this agreement. The cost for this scope of services is based upon the above referenced line items. Upon receipt of approval for this proposal, this task is anticipated to be initiated immediately and shipped within 12 weeks from the issuance of the purchase order. The total cost for each module is as follows:

REMSYS Model: LP2-HF (1-40 gpm) Low Profile Stripping Tower

REMSYS Model: CC-1000-CS (1,000 lb.) Liquid Phase Carbon Canister

Ronningen-Petter Model: CST-224-LP Bag Filter

Grundfos EP-150-5050 E Series Sump Pump

14' X 6' X 8" ID dimensions - Polyurethane Acrylic Coated Carbon Steel Skid

Wastewater Treatment System Control Module

LUMP SUM BID PER MODULE:

\$ 28,925.50



PN 93 1041-1TX
 IT Corporation
 Carswell A.F.B.
 June 18, 1993

Task 4.0 - Install Pumping and Treatment Systems

4.1 REMSYS will provide and install a groundwater pumping system in six of the seven existing recovery wells required to be addressed in this task (the seventh was addressed in Task 2.2). Each system will include a Grundfos Model 25S10-7 stainless steel submersible well pump capable of delivering 30 gpm at 110 ft. TDH. This pump will be installed with 1-1/2" stainless steel riser pipe, well seal, and level control electrodes. A locking and weather tight control panel will be installed near each well head. This control panel will contain the pump motor starter, level relay, on-off-auto switch, and running indicator light. Electrical power for each pump will be provided from a single control module that is inter-locked with the control modules addressed in task 4.2.

4.2 REMSYS will install the five (5) modular air stripping units at the northern end of White Settlement Road. Each skid unit will be securely mounted on the asphalt pavement with cinch-anchors. The influent and discharge to each treatment unit will be connected to the collection and discharge pipe installed in Task 1.0. Valves will be provided to balance the flow to each unit. Electrical power for the treatment units shall be connected from the same power source supplied by Carswell AFB as the rental treatment unit. Electrical power wires for each recovery well will have been previously installed in Task 1.0. Control wires from the treatment units to the recovery wells will also have been installed through the existing conduit in Task 1.0. A master control relay has been provided to shut down all the recovery wells if a low air flow alarm through any air stripper, or a high level alarm in any air stripper sump occurs.

4.3 Schedule and Cost

REMSYS will initiate these services immediately upon receipt of IT Corporation's acceptance of this agreement. The cost for this scope of services is based upon the above referenced line items. Upon receipt of approval for this proposal, this task is anticipated to be initiated immediately and installed approximately October 7, 1993 with date of completion projected for October 21, 1993. The total cost for each task is as follows:

(4.1) Stainless Steel Submersible Well Pumps

INSTALLATION PER WELL

Labor Title	Rate	Hours	Total
Project Manager	40.00	3	120.00
Remedial Tech	25.00	3	75.00
Remedial Tech	25.00	3	<u>75.00</u>
Sub Total:			\$ 270.00

PN 93.1041-1TX
 IT Corporation
 Carswell A.F.B.
 June 18, 1993

179195



PARTS REQUIRED PER WELL

Quantity	Description	Unit Costs	Total
40'	1-1/2" 304 Stainless Steel Pipe	9.08 / ft.	363.20
3	304 Stainless Steel 1-1/2" Couplings	10.21	30.63
1	Grundfos Model (25S10-7) 3 phase Motor Well Pump	1,128.41	1,128.41
1	NEMA 4 Well Pump Control Module with Level Control Probes	702.50	<u>702.50</u>
Sub Total:			\$ 2,224.74

LUMP SUM BID PER WELL (Task 4.1): \$ 2,494.74

(4.2) Installation of 5 Modular Air Stripper Treatment Units

INSTALLATION

Labor Title	Rate	Hours	Total
Project Manager	40.00	20	800.00
Remedial Tech	25.00	20	500.00
Remedial Tech	25.00	20	500.00
Journeyman Electrician	25.00	48	<u>1,200.00</u>
Sub Total			\$ 3,000.00

PLUMBING PARTS REQUIRED

Quantity	Description	Unit Costs	Total
10	3" X 2" Reducers - Schedule 80	8.33	83.30
9	3" T's - Schedule 80	10.29	92.61
100'	3" Schedule 80 PVC Pipe	1.10 / ft.	110.00
5	1 1/4" Diaphragm Valves	131.07	655.35
17	3" 90's - Schedule 80	5.58	94.86
16	2" 90's - Schedule 40	.94	15.04
100'	2" Schedule 40 PVC	.44	44.00
5	3" X 1 1/4" Reducers	8.33	41.65
20'	1 1/2" thick X 3" Metal Wrap Pipe Insulation	5.19 / ft.	103.80
100'	1 1/2" thick X 2" Metal Wrap Pipe Insulation	3.89 / ft.	<u>389.00</u>
Sub Total:			\$ 1,629.61

PN 93 1041-1TX
IT Corporation
Carswell A F B
June 18, 1993

1.79196



SPECIAL EQUIPMENT REQUIRED

Quantity	Description	Unit Costs	Total
20	Cinch-Anchors (4 per Unit)	50.00	1,000.00
6 hrs.	Crane	120.00 / hr.	<u>720.00</u>
Sub Total:			\$ 1,720.00

ELECTRICAL PARTS REQUIRED

150' - 1/2" Ridged Galvanized Conduit
120' - 3/4" Ridged Galvanized Conduit
300' - 12 gauge THHN Coated and Stranded Copper Wire
Misc. Fittings, Unions, Nipples, Locknuts, etc.
1 - Electrical Service Truck

Sub Total: \$ 512.25

LUMP SUM BID (Task 4.2): \$ 6,861.86



Task 5.0 - System Maintenance

5.1 The Operations and Maintenance Schedule proposed herein is based upon the minimum time allowed for the continuous and successful operation of a groundwater treatment facility. The following services will be performed by **REMSYS** to accomplish the required maintenance tasks during the approximate 24 month service period:

- Conduct site visits on a once weekly basis.
- Perform system function testing and record operational system dynamics.
- Conduct electrical systems checks as required.
- Inspect all system components on a weekly basis for component wear, operation efficiencies, iron precipitate build-up, backflushing requirements, and other required maintenance items.
- Collect samples as required by the permitting agencies.
- Review documentation pertaining to flow rates, treated gallonage, and treatment efficiencies achieved for each months' operation.
- Submit a monthly maintenance report and summary to IT Corporation with invoice.
- Annually, replace spent carbon to assure the continued successful operation of the groundwater pumping and treatment systems.

5.2 Schedule and Cost

The total cost for this maintenance program, based on a 24 Month Contract, is **\$625.00 / Month / System** and will be initiated by **REMSYS'** personnel following each treatment system start-up. Any parts required to maintain each system not covered by warranty will be billed at cost plus 15%. Our fee will be billed at the conclusion of each months' reporting period with payment due within 45 days.

Annually, each canister will have the carbon replaced. The total cost for this "Carbon Change Out Service" which includes labor, drums, and vacuum system is **\$ 675.00 / System**. Each canister requires 1,000 pounds of carbon at a cost of **\$1.66 per pound**. The spent carbon is to remain the property of The United States Air Force, or its' designated agent.

PN. 93.1041-1TX
IT Corporation
Carswell A F B
June 18, 1993

1.79198



ESTIMATED WORK SCHEDULE

(Special Progress Payment Consideration Requested)

Date	Description	Payment
July 02, 1993	Purchase Order Issued	43 % Down - Task 1.0
July 06, 1993	Begin installation of collection pipe and electrical conduit	
	Begin installation of groundwater pumping system in CAR-RAW	
July 19, 1993	Complete Task 1.0	Balance Due Net 30 - Task 1.0
July 16, 1993	Begin Installation of Rental Air Stripping Module	43% Down - Task 2.0
July 19, 1993	Complete Task 2.0	Balance Due Net 30 - Task 2.0
July 05, 1993	Commence Fabrication of Modular Units	33% Down - Task 3.0
Sept. 02, 1993	Continuation of Fabrication	33% Progress - Task 3.0
Sept. 19, 1993	Begin Testing 5 Modular Air Stripping Units	
Sept. 24, 1993	Begin Shipping 5 Modular Air Stripping Units	
Oct. 07, 1993	Begin Installation of Groundwater Pumping Systems in the six (6) existing recovery wells	40% Down - Task 4.1
Oct. 12, 1993	Complete Task 4.1 - Remove Rental Unit	Balance Due Net 30 - Task 4.1
Oct. 14, 1993	Begin Installation Modular Air Stripping Units	40 % Down - Task 4.2
Oct. 21, 1993	Complete Task 3.0	Balance Due Net 30 - Task 3.0
Oct. 21, 1993	Complete Task 4.2	Balance Due Net 30 - Task 4.2
Oct. 21, 1993	Begin Operations and Maintenance on Units	Monthly Balance Due Net 45

179199



PN: 93.1041-1TX
IT Corporation
Carswell A.F.B.
June 18, 1993

Should additional services be required, **REMSYS** can supply these services under separate contract. I appreciate this opportunity to bid on this project. If any revisions are necessary, or you have any questions, please feel free to contact me at any time.

Sincerely,
REMSYS INDUSTRIES, INC.

Stephen W. Erickson
President

SWE/pge

Enc.

AGREED TO AND ACCEPTED UNDER THE CONDITIONS AND SPECIFICATIONS CONTAINED HEREIN.

BY: International Technology Corporation

AUTHORIZED SIGNATURE: _____ DATE: _____
International Technology Corporation will be Responsible for any required Sales Tax.

179200



6.0 - Asphalt Pad Proposal:

6.1 REMSYS proposes, as an additional task, to construct a 50' X 25' X 6" asphalt pad to hold the groundwater treatment units, transformers, and electrical service boxes. This proposal would be accomplished in conjunction with Task 1.0. The pad would be surrounded by a 6' chain link fence with 3 strands of barbed wire around the top and vision barriers in the fence (optional). There would be a 25' gate at one end and a manway gate on the opposite end.

The fence would be marked on each side with twelve (12) of the following signs:

U.S. Government Property
Do Not Enter
Wastewater Treatment Facility
Danger
High Voltage

6.2 Schedule and Cost

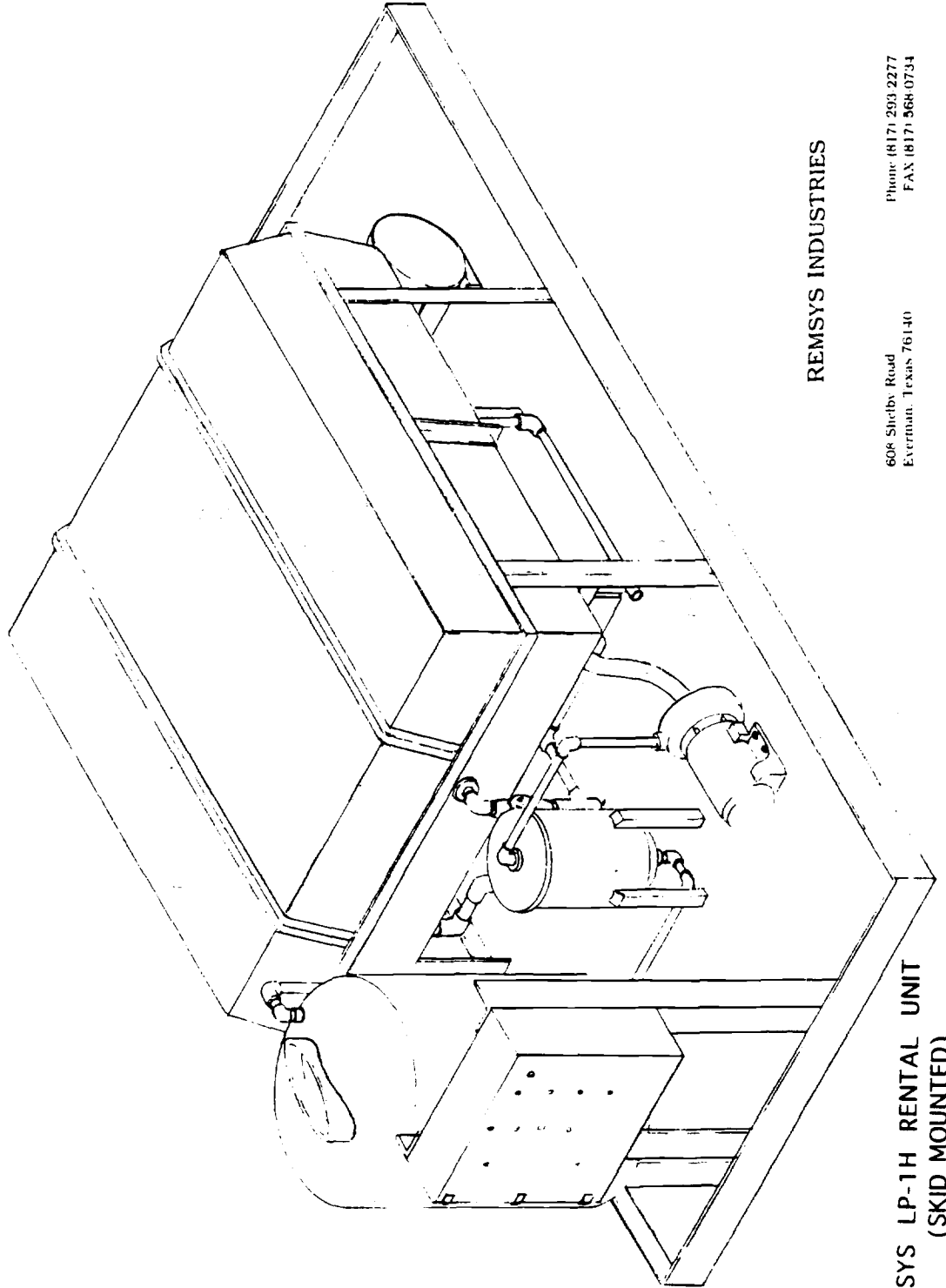
Asphalt Pad Construction	3,950.00
Fence Construction with Privacy Slats	2,600.00
Signs (12)	<u>735.00</u>
Total Cost with Privacy Slats:	\$ 7,285.00
Asphalt Pad Construction	3,950.00
Fence Construction without Privacy Slats	1,800.00
Signs (12)	<u>735.00</u>
Total Cost without Privacy Slats:	\$ 6,485.00

REMSYS proposes to use the Minority Contractor listed below for the fence installation:

A. J. & Ramrod Fence Company
3713 N. Little John
Ft. Worth, Texas 76105

Contact Person: Mr. A.J. Houston
(817) 534-0853

179201

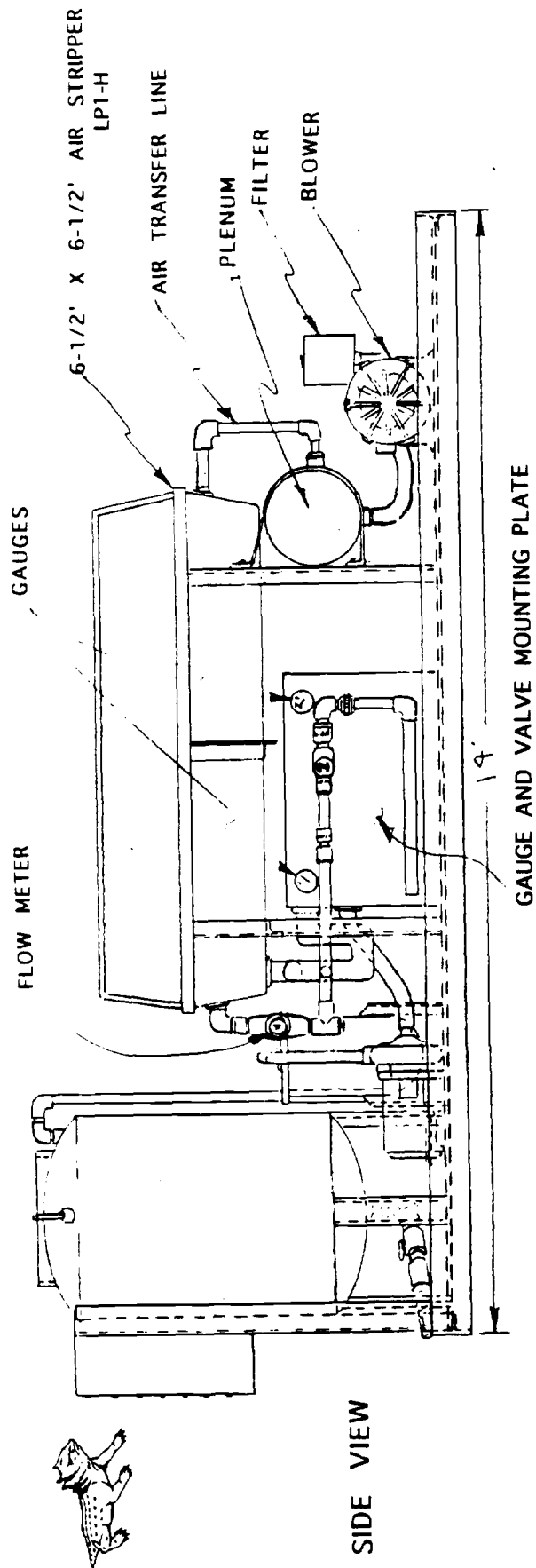


REMSYS INDUSTRIES

Phone (817) 293-2277
FAX (817) 568-0734

608 Shetby Road
Everman, Texas 76140

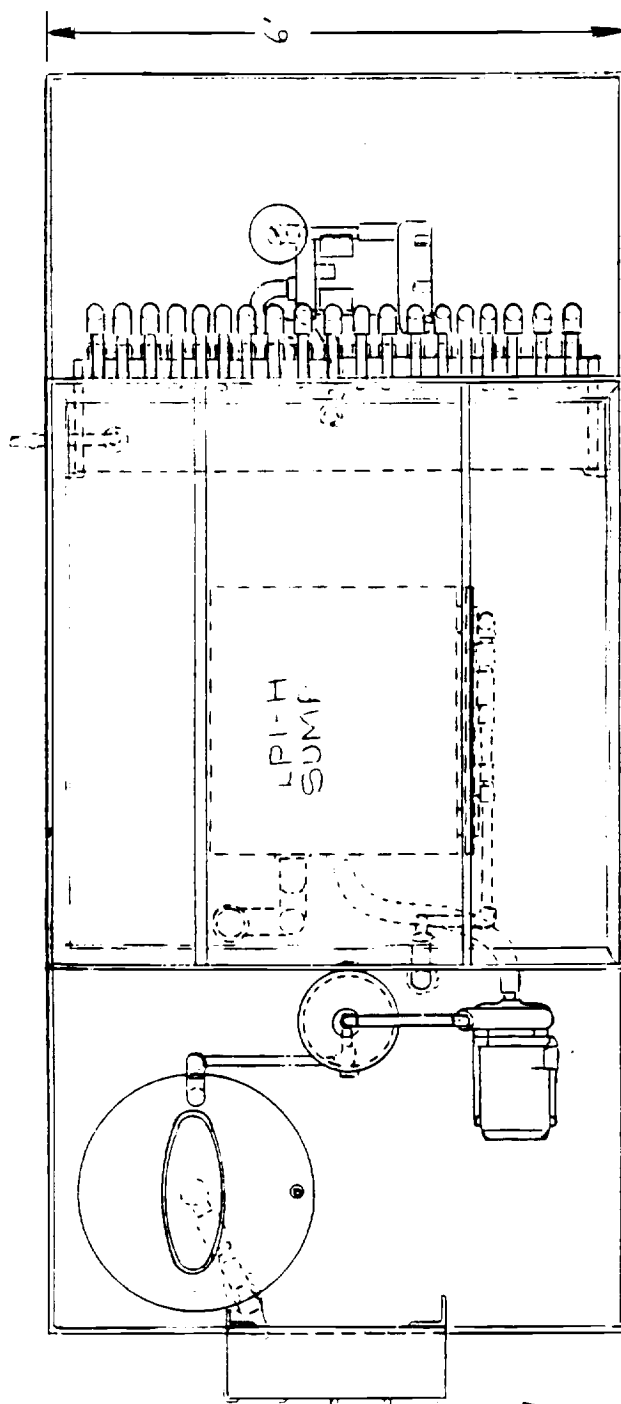
REMSYS LP-1H RENTAL UNIT
(SKID MOUNTED)



SIDE VIEW



179203



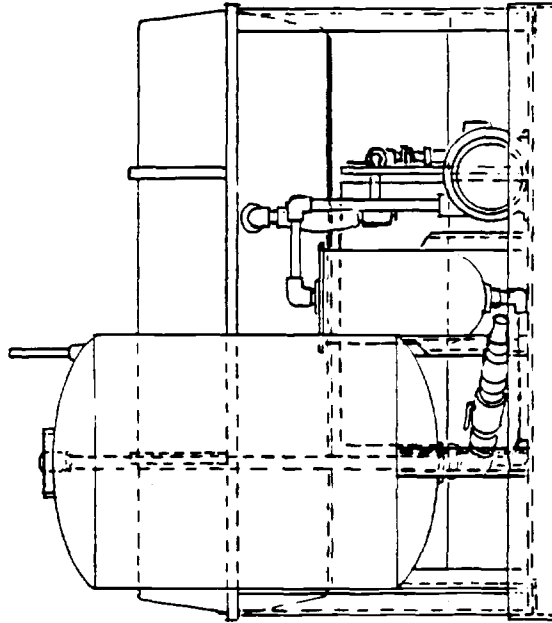
PLAN VIEW



MEMORANDUM

Phone (817) 293-2277
FAX (817) 568-0734

608 Shelby Road
Everman, Texas 76140



END VIEW
CIRCUIT BOX OMITTED
FOR CLARITY

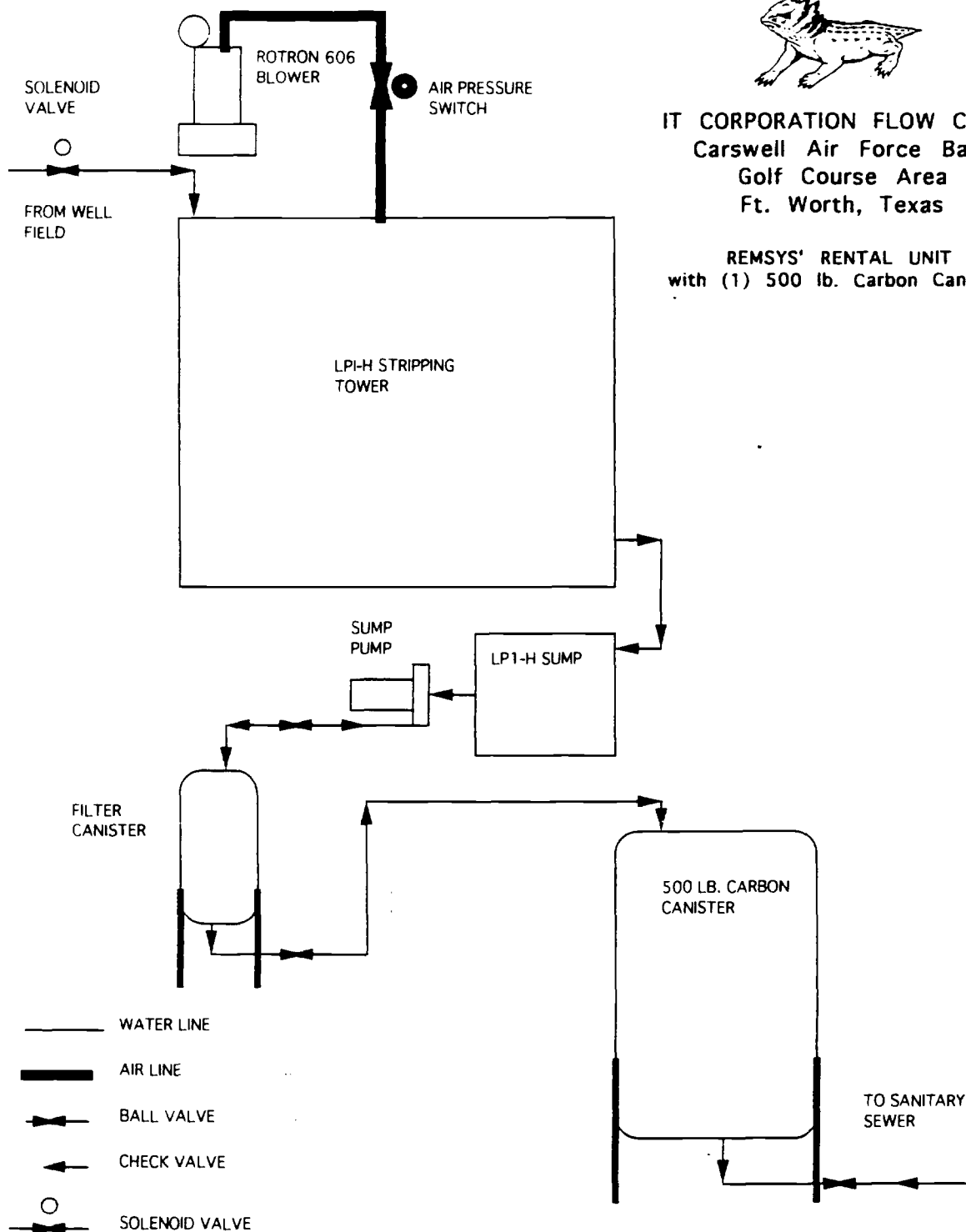
179204

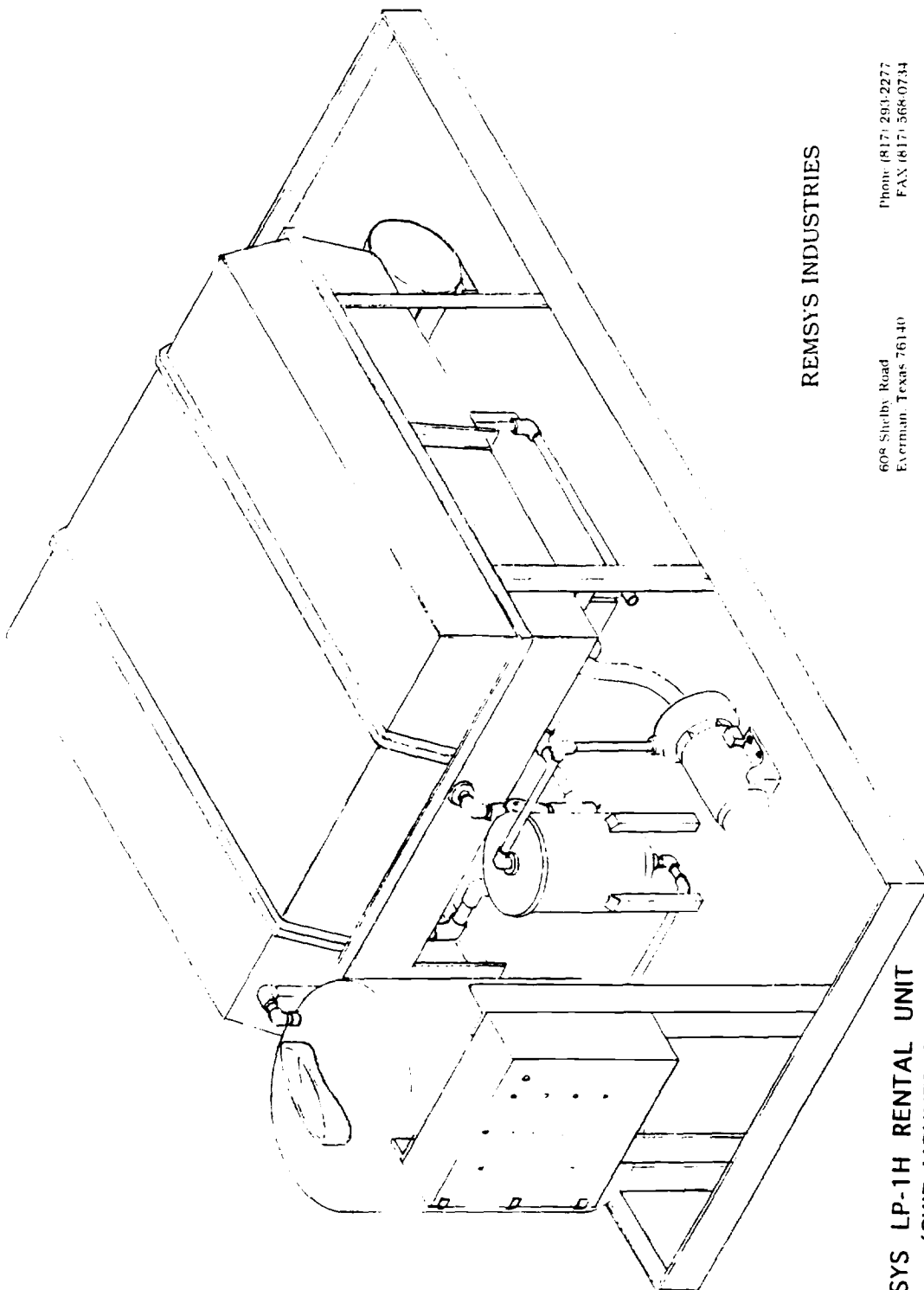
179205



IT CORPORATION FLOW CHART
Carswell Air Force Base
Golf Course Area
Ft. Worth, Texas

REMSYS' RENTAL UNIT
with (1) 500 lb. Carbon Canister





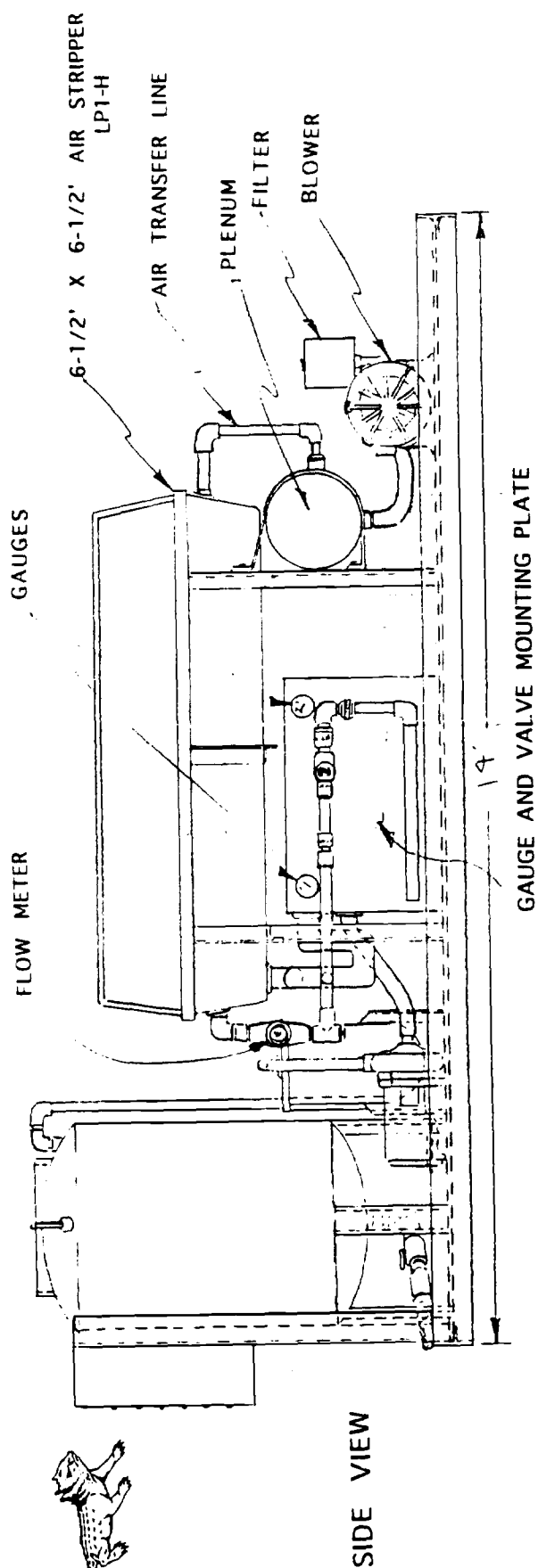
REMSYS INDUSTRIES

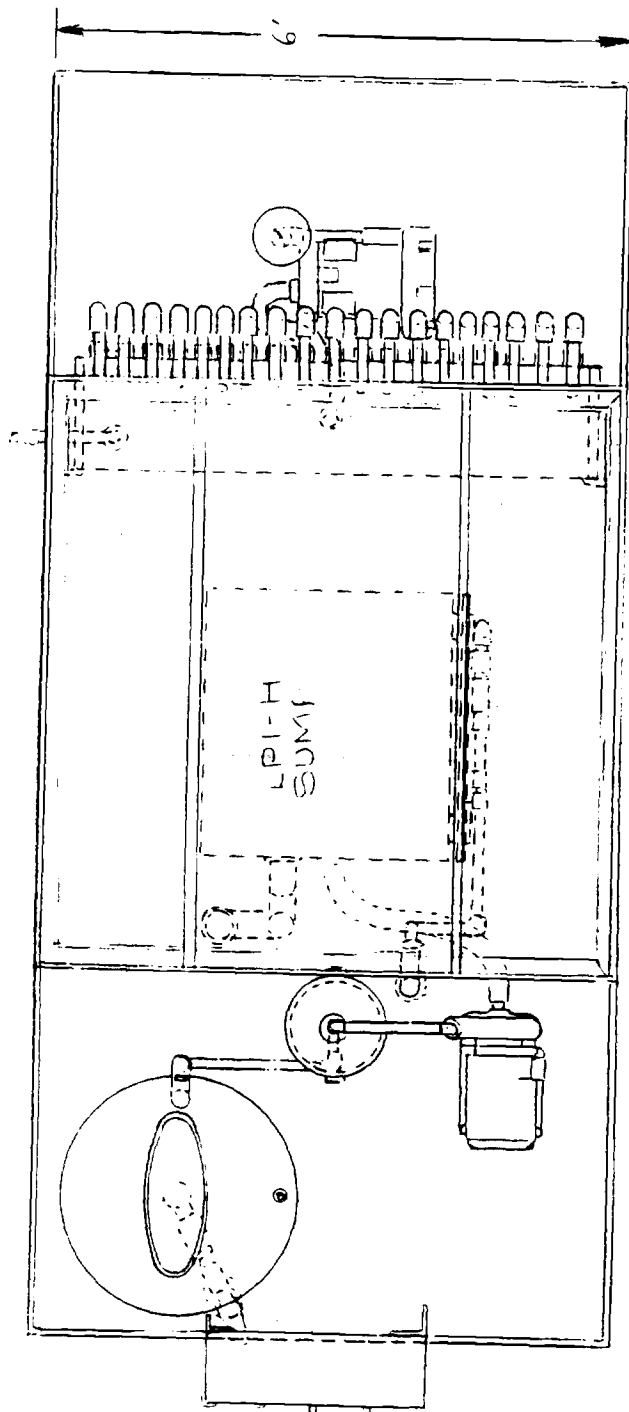
Phone: (817) 293-2277
FAX: (817) 568-0734

609 Shelby Road
Euromat, Texas 76140

REMSYS LP-1H RENTAL UNIT
(SKID MOUNTED)







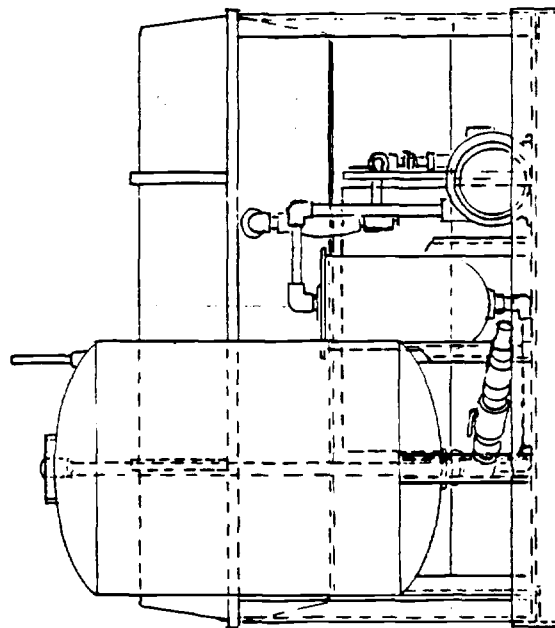
PLAN VIEW





REMSYS INDUSTRIES

608 Shelby Road
Everman, Texas 76140
Phone (817) 293-2277
FAX (817) 568-0734



END VIEW
CIRCUIT BOX OMITTED
FOR CLARITY

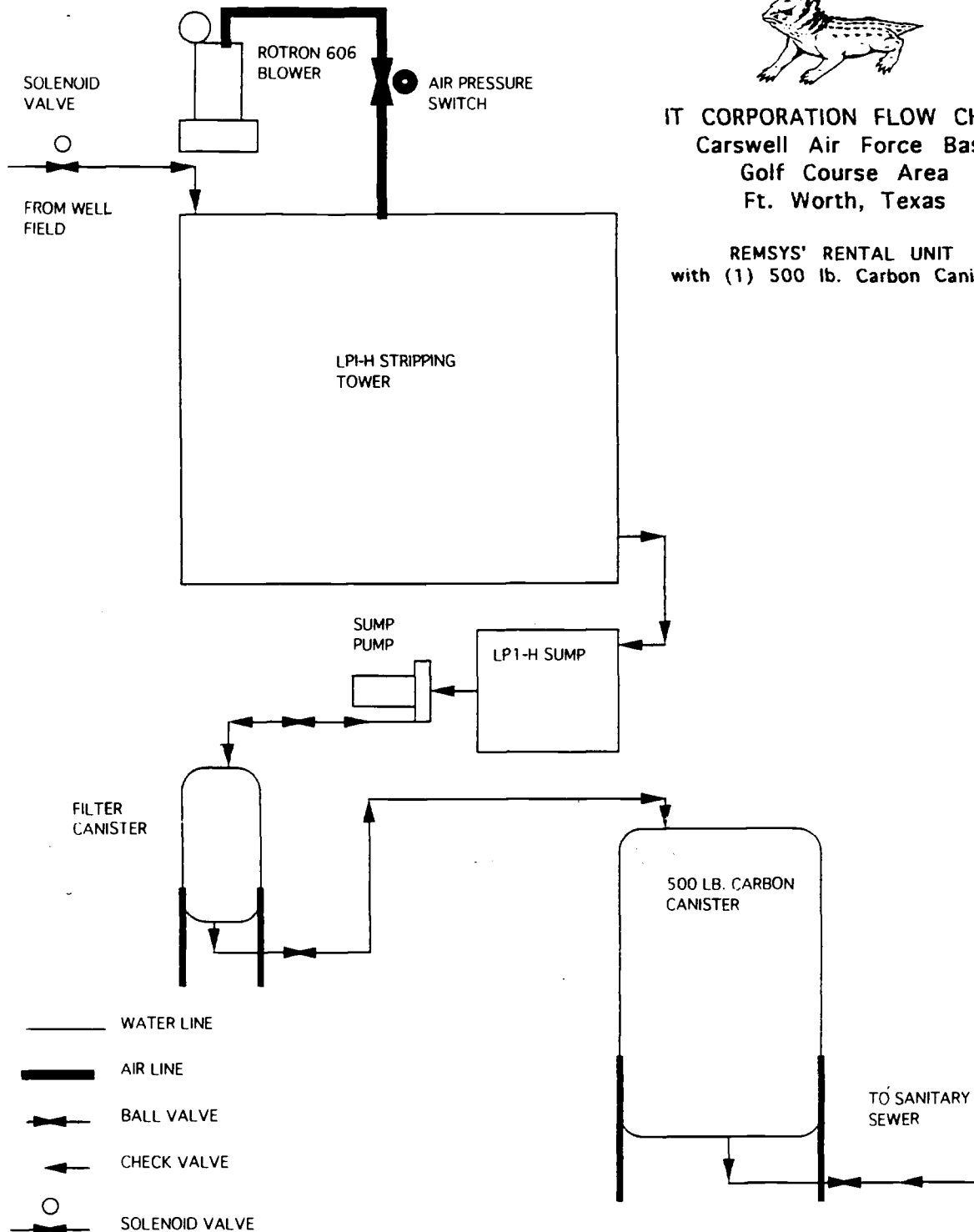
179209

179210



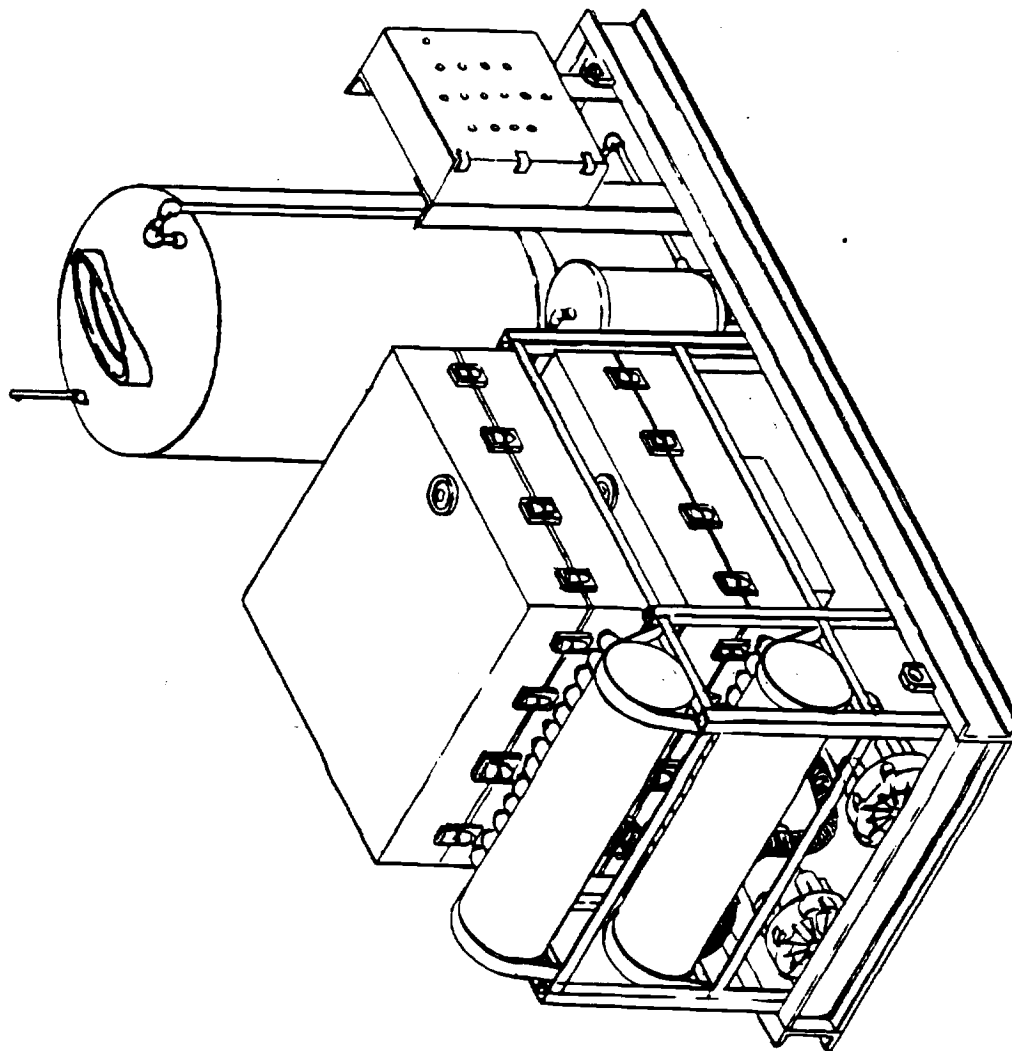
IT CORPORATION FLOW CHART
Carswell Air Force Base
Golf Course Area
Ft. Worth, Texas

REMSYS' RENTAL UNIT
with (1) 500 lb. Carbon Canister





REMSYS LOW PROFILE AIR STRIPPER
Model: LP2-H (1-40 gpm)



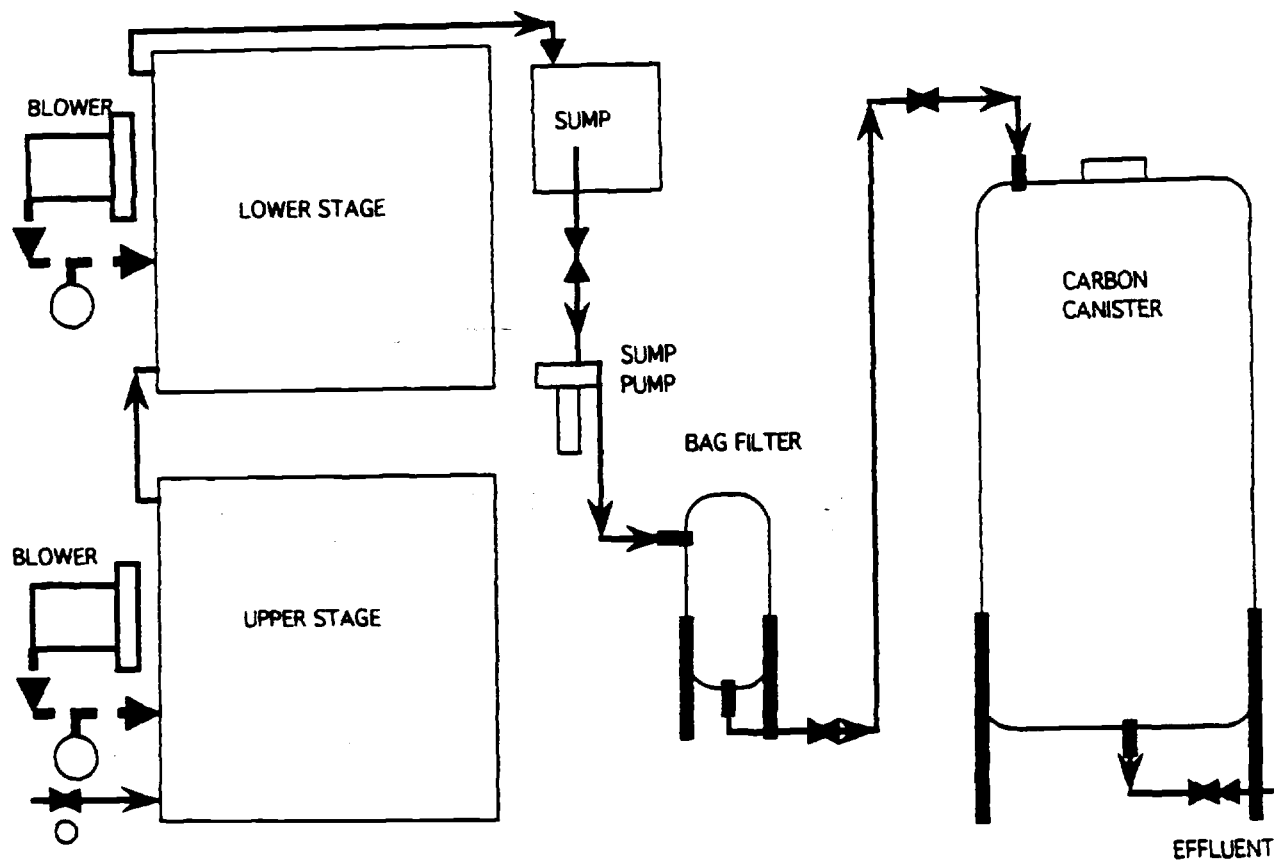
REMSYS INDUSTRIES

179211



IT CORPORATION FLOW CHART
Carswell Air Force Base
Golf Course Area
Ft. Worth, Texas

179212



INFLUENT



BALLVALVE



HIGH/LOW PRESSURE SWITCH



SOLENOID SWITCH



CHECK VALVE

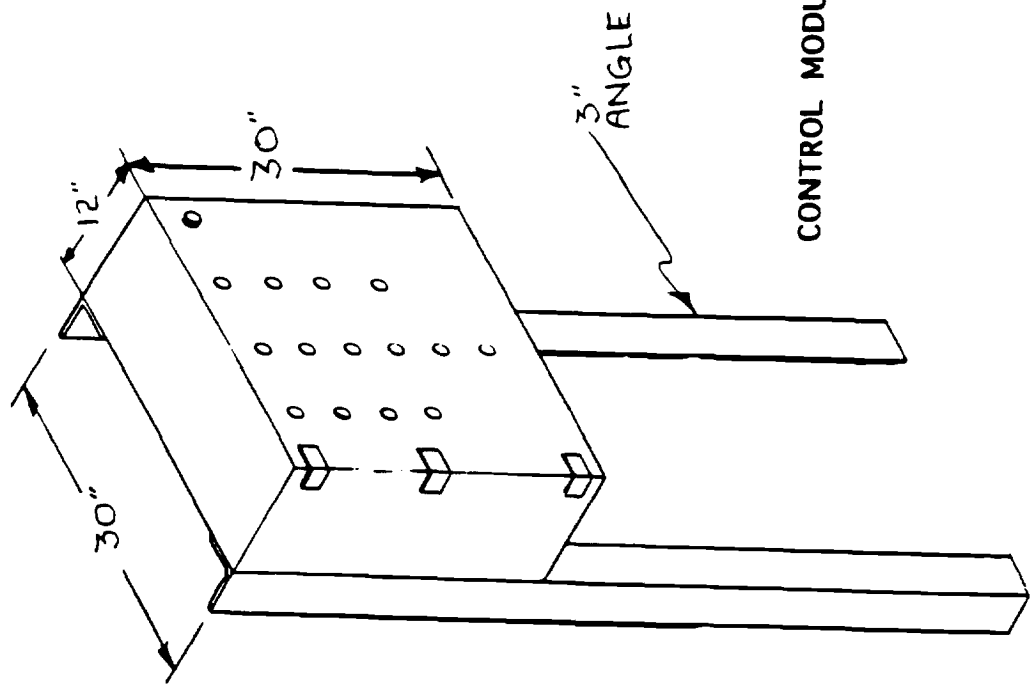
REMSYS INDUSTRIES

608 Shelby Road
Everman, Texas 76140

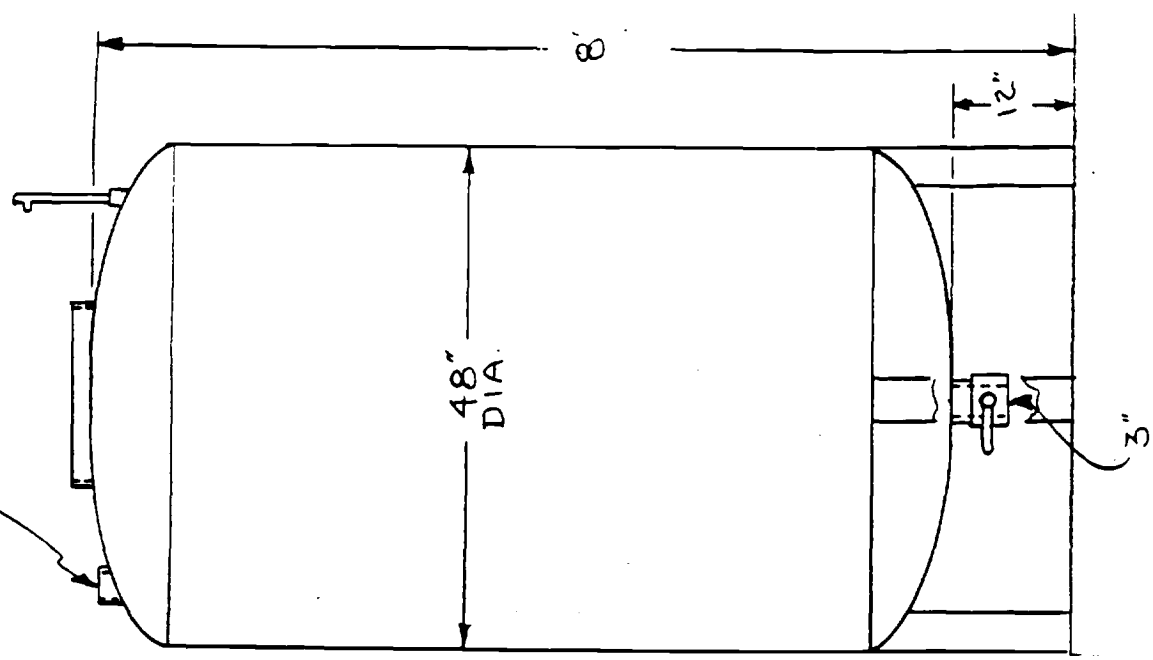
Phone (817) 293-2277
FAX (817) 568-0734



2" C-)-(



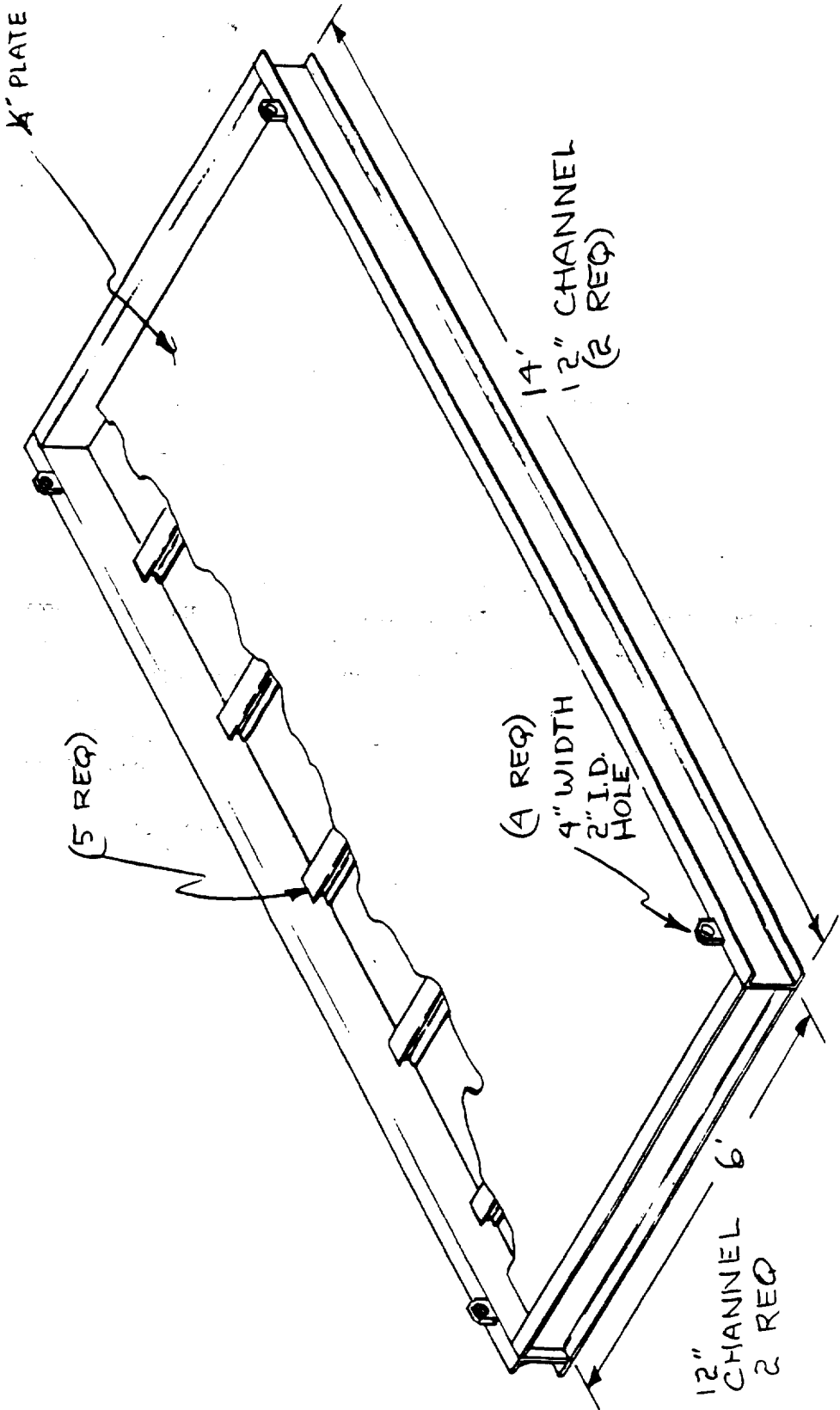
CONTROL MODULE



179213

REMSYS INDUSTRIES

REMSYS INDUSTRIES



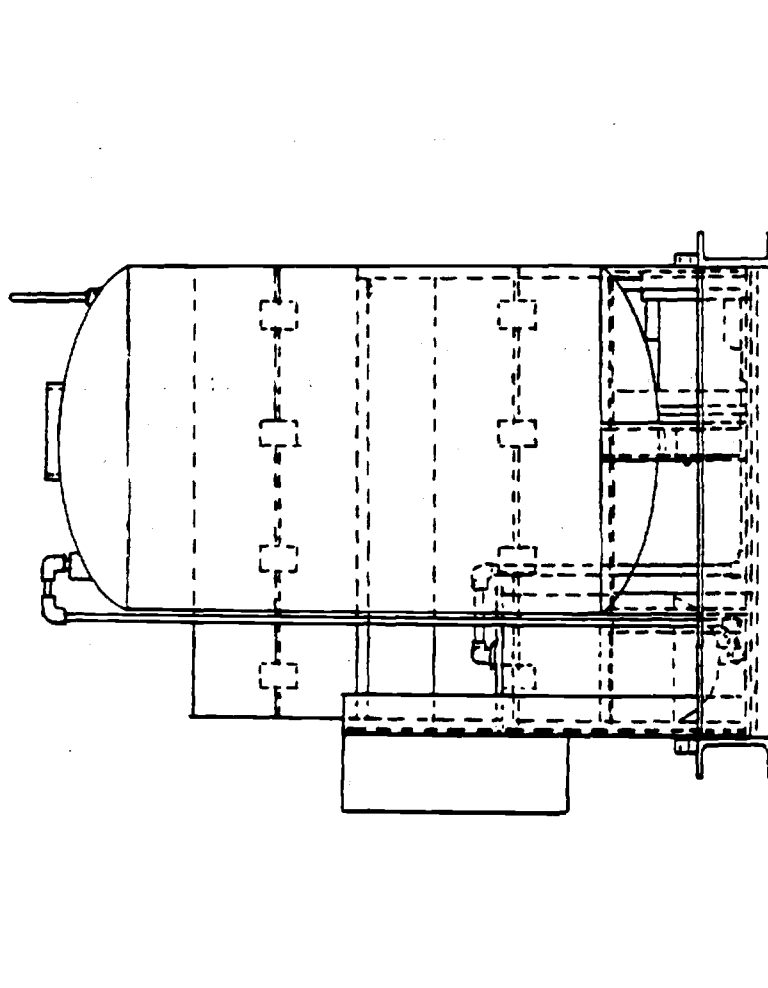
REMSYS SKID

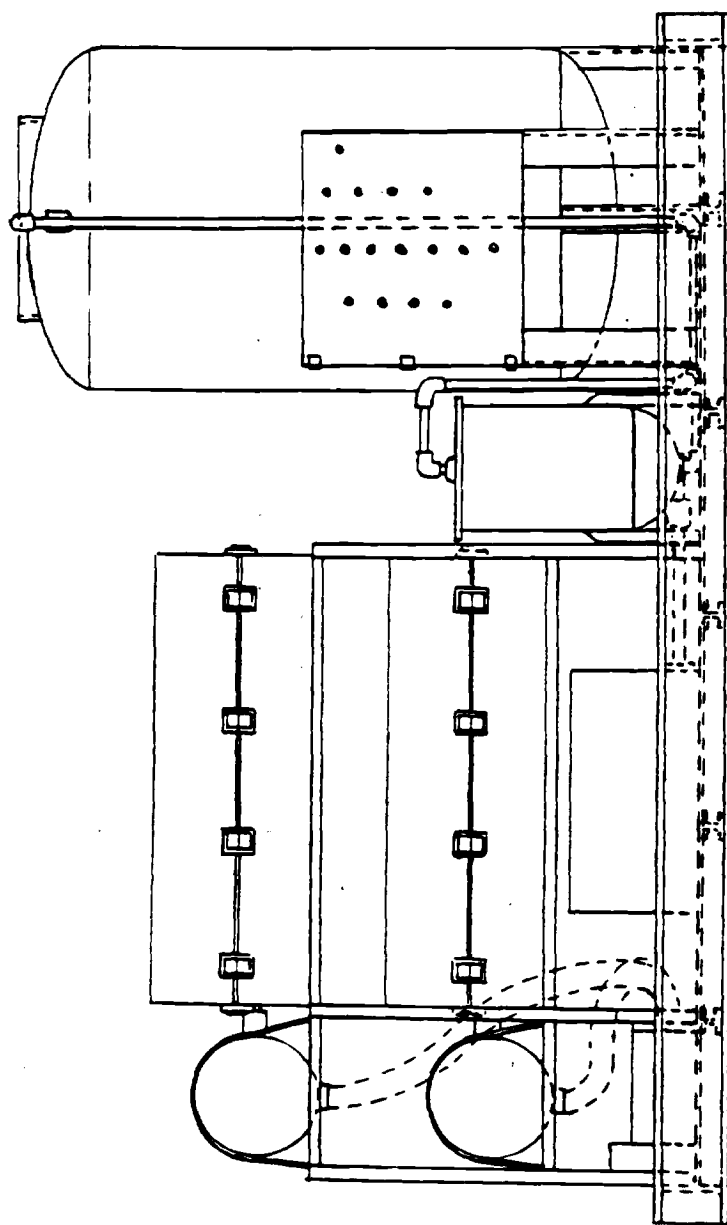


179215

REMSYS INDUSTRIES

END VIEW



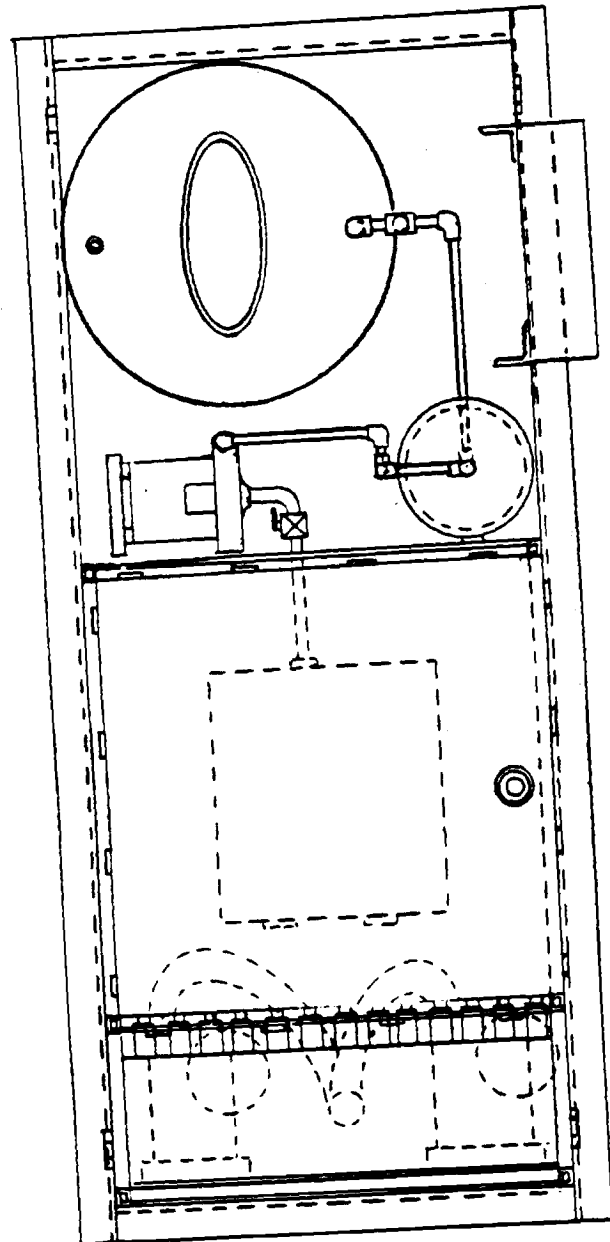


SIDE VIEW

REMSYS INDUSTRIES

179216

179217



REMSYS INDUSTRIES

179217

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE